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CENTRAL STATION STATISTICS.

The statistics we print in another column relating to the London central stations, will be found of much interest by all connected with the business of electric lighting, either professionally or financially. Owing to the English Board of Trade rules, the collection of such statistics in Great Britain is possible, and they furnish a valuable means for the comparison of the results of operations in different plants, thus enabling the managers to discover their own shortcomings. In view of the extremely low figures so frequently given for the cost per kilowatt-hour of electrical energy, we call particular attention to the total cost of this item for the different central stations given.

UNDERGROUND WIRES IN BOSTON.

The interesting account by Mr. Talbot in another column of the underground subways of Boston, incidentally illustrates the enormous extent of the applications of electricity. We learn that there are in use in that city 220,000 incandescent lamps and 6,600 arc lamps, and that the total amount of electrical energy generated aggregates 28,000 horse-power. The mileage of underground telephone wire is 11,200 miles and no less than 17,050 miles underground wire are employed for all telephonic and telegraphic purposes. Very fortunately for it, Boston did not adopt the policy of New York as to the construction and ownership of subways, as they are there built and owned by the operating companies under the supervision of a competent municipal officer, subject to appeal to a municipal board which includes the city engineer.

THE BERLINER PATENT.

In another column we print an article giving the results of a close study of all of the facts accessible affecting the Berliner microphone patents, and which forms one of the most interesting contributions yet made to the literature of the subject. As will be seen, Dr. Frost claims that certain very important evidence affecting the validity of the Berliner patent recently in suit was neglected by the government. The article relates to modifications made in the patent application of Berliner, whereby its entire bearing was changed. The specific charge is that on Sept. 1, 1880, and not until then, the constant-pressure principle was introduced, constant-pressure electrodes being then first described and claimed. It is held that this substitution of new matter was entirely unjustifiable and illegal, and that a decision of the commissioner of patents on a certain vital point was stretched to mean something entirely different, the patent being granted on this unwarranted construction. Dr. Frost presents all of the facts upon which he bases his opinion, and we shall be pleased to print the comments of others on this evidence.

A NEW DEPARTURE IN STEAM ENGINE ECONOMY.

Prof. Andrew Jamieson in a recent paper read before the Scotch Institution of Engineers and Shipbuilders, describes a new method for augmenting the economy of steam engines, and gives the results of tests which support the claims made. The method consists in admitting hot air to the jacket and interior of a steam cylinder. The air in the experiments described had a pressure of one and three quarter pounds per square inch and was delivered into the cylinder at a mean temperature of 553 degrees Fah., and to the jacket at a temperature of 380 degrees Fah. The air was heated by passage through an apparatus similar to a Green economizer, and admitted to the cylinder through special cylinder covers, each containing several inlet valves, which automatically opened inward as soon as the exhaust steam commenced to escape,

and continued open until compression commenced. It will be seen that this is quite different from the well-known method of introducing hot air into the entering steam, though considerable economy has also been claimed for this process. By the new method the temperature of the whole interior surface of the cylinder is claimed to be heated to a point far exceeding that of the steam, and consequently condensation entirely avoided. In a test made with a single-cylinder non-condensing engine, a horse-power was developed on 18.6 pounds of steam per hour, which, it is perhaps needless to add, is a remarkable result, exceeding the efficiency of the usual condensing compound engine. Prof. Jamieson, who conducted the test, is a most competent authority, and the endorsement which he gives the new method is sufficient to call for its most careful consideration by steam users.

THE INVENTION OF THE ELECTROMAGNETIC TELEGRAPH.

In this issue appears the first of a series of elaborate articles on the invention of the electromagnetic telegraph, the object of which is more particularly to settle the relative merit due to the several persons taking part in the invention. The first article is from the pen of Mr. Francis W. Jones, electrical engineer of the Postal Telegraph Company; proofs of this article were submitted to the several contributors to the series, and it therefore to some extent served as a basis for the other articles. The second article will be by Mr. Franklin L. Pope, formerly electrician of the Western Union Telegraph Company, and will include the result of much research among original papers relating to the early days of the telegraph. While neither of the above articles was written with the purpose of bolstering up partisan claims, but on the contrary are confined to strict consideration of facts, yet they may be said to differ considerably in their estimates of the relative merit to be assigned to Morse and Vail. The third article will be by Mr. J. J. Fahie, the author of the "Early History of the Electric Telegraph," who will consider the question from the English standpoint. The German view of the subject will be presented by Herr Postrath Petsch, a prominent official in the German Imperial Telegraph service. Mr. A. M. Tanner will contribute the final article to the main series, giving the French view. Mr. Tanner has been pronounced by Hospitalier to have a marvelous scent for "prehistoric" inventors and inventions, and his article will give the result of extensive researches among French patent archives. The final articles in the series will be contributed by members of the several families whose names are connected with the invention of the telegraph, and will be in the nature of rejoinders to the main discussion, which presumably will include the facts at issue. The object of the series, as stated recently in these columns, is to terminate, if possible, a controversy which has now been going on for a half-century, and whose fruitlessness is to be ascribed to the lack of the dispassionate spirit which, we believe, will be found a characteristic of the articles whose publication we now begin.

JUDGE COXE AND ELECTRIC TRACTION.

In another column we print in abstract the recent decision rendered by Judge Coxe, at Elmira, in the trolley case involving one of the Van Depoele patents, and which is the first important decision yet made involving electric railways. The Field and other "fundamental" cases had much more involved, but as they were purely patent attorneys' "paper" inventions, their fate was preordained. In the present instance the issue is a legitimate one, but it is not, we believe, one which is terminated by Judge Coxe's opinion. Our readers may perhaps retain some recollection of Judge Green's singular feeder-and-main opinion, the premise of which was, apparently, that Edison is one of the greatest men of all time, and the conclusion, that, therefore, his feeder-and-main patent was valid. The opinion of Judge Coxe bears a close resemblance to this celebrated opinion. We find the same misconception as to the difficulties met in the early days of the art, which are set forth in rhetorical language, that has more resemblance to a Fourth of July oration than to a judicial utterance. We also find that, similarly, the personality of the inventor had a strong hold on the judgment. Even the most ardent of Van Depoele's admirers would scarcely contend that to him "more than to any other man belongs the credit of having made the electric railway a practical success." Having laid down the proposition that the development of the electric railway was a problem of the utmost difficulty, and one which taxed the ingenuity of many inventors, and that the contributions of Van Depoele rapidly supplanted the "crude and tentative prior structures," the judge, as he frankly states, naturally approaches the controversy "in a liberal spirit and with an inclination to give the inventor the full fruits of his invention." In other words, instead of considering the points in dispute in a judicial manner and solely on their merits, he first forms entirely erroneous general opinions with respect to the technical difficulties met with in the development of the electric railway, submits himself to the influence of the inventor's personality, and then proceeds to examine the matter at issue with a confessed inclination thus engendered.

Meetings of the American Society of Mechanical Engineers.

In an editorial in the current issue of the *American Machinist*, the non-enforcement of the rules of the American Society of Mechanical Engineers relating to the presentation and discussion of paper is severely criticised.

Stated briefly, these rules provide that all papers to be presented at a given meeting shall be prepared and submitted in time to get them in type three weeks before the time of the meeting. It is expected that every member who intends to be present at the meeting will receive printed copies beforehand, and will familiarize himself with such of them as he is specially interested in or wishes to discuss. This makes it unnecessary that papers should be read in full, and the rules, therefore, provide that abstracts only shall be presented, and that not more than five minutes shall be allowed for the presentation of any one paper.

Regarding discussions of papers, the rules provide that, where a member has reduced his discussion to writing, he may have 10 minutes in which to present it, but that extemporaneous discussion shall be limited to five minutes for each speaker, and that no speaker shall claim the floor the second time until all who wish to speak upon the subject have had an opportunity to do so. Not a single requirement of these rules, says the editor, was observed during the recent meeting. One member spent at least half an hour in what was virtually an extemporaneous address upon a range of subjects more or less remotely connected with the subject of his paper, which he was supposed to be presenting by abstract, and in discussion each member spoke as long as he thought he had anything to say, and took the floor as often as he choose, seldom even waiting for recognition by the chair, or seemingly to think of observing either the special rules governing the society, or the common rules supposed to govern all deliberative bodies.

It is also stated that for some time past there has been too much laxity in the matter of accepting and presenting papers not received in time to be sent out to members in advance of the meeting, thus preventing their previous study as contemplated by the rules. In the case of this last meeting, this mistake was avoided; papers received too late were held over for presentation at a future meeting, and those accepted were sent to members in time for study and preparation of discussions. Under such circumstances the editor considers that nothing short of the repeal of rules by the society justifies their abandonment during a meeting, and no member has a right to object to their courteous but firm enforcement; while all members who attend have a right to expect that rules adopted deliberately and in the interest of the membership generally, will be observed by all members and enforced by the presiding officer.

As to abstracts of papers, it is suggested that these might be made by the secretary of the society, or, each author required to present with the manuscript of his paper an abstract of it, to be passed upon by the publication committee, printed with the paper and read by its author or the secretary in presenting it.

The First Important Trolley Decision.

The recent decision of Judge Coxe sustaining one of the earlier Van Depoele trolley patents is the first rendered bearing on trolley mechanisms, and unless reversed may have important consequences. The parties behind the suit were the General Electric and Westinghouse companies, the former as complainant through the Thomson-Houston Electric Company, and the latter as defendant through the Elmira & Horseheads Railway Company. The patent at issue was granted to C. J. Van Depoele April 1, 1890, on an original application filed March 12, 1887, and divided Oct. 22, 1888. It contains no less than 35 claims, in reference to which the court says that the real invention is obscured in "a multitude of fuliginous and attenuated claims," and a seemingly needless verbosity, resulting in an indistinctness annoying to the public and "particularly to that part of the public which is called upon to construe the patent."

The court divides the patent into three parts: First, the contact device, commonly known as the "trolley"; second, the support therefor; and, third, the overhead switching devices.

The contact device is the usual trolley and is described as consisting of a grooved wheel mounted upon a pivoted support on the roof of the car having a sufficient capacity of vertical and lateral automatic adjustability and capable of being detached and lowered by an attendant on the car platform.

The support is a pole or arm mounted on the roof of the car and pivoted and swiveled so as to be capable of swinging both vertically and horizontally. Attached to the short arm of this pole is a weighted spring which operates to maintain normal contact between the grooved wheel and the suspended conductor. The overhead switching devices are placed at points on the line of the road where branches and turnouts occur, and where the overhead trolley wires are required to branch correspondingly with the tracks. The object is to transfer the trolley from the main wire to the branch wire, and *vice versa*, without interrupting the contact.

The switching device, as shown in the patent, consists of a Y-shaped plate of sheet metal, with depending side flanges. This plate is secured to the under side of the trolley wire at the point where it branches, the narrow end being turned in the direction of the main wire, and the other end being connected with both the main and branch wires. The narrow end is wide enough to permit of the easy movement of the trolley wheel through it, while the other end is wide enough to permit the wheel to move out in the direction of either the main or the branch wire. The switch device is placed at the junction of the main and branch wire above the corresponding switch on the track, and the wheel is to be so supported on the roof of the car that it will not reach the switch-box until at least the forward wheels of the car have passed the junction of the main and branch tracks. Thus, the switch-box will guide the wheel automatically upon that one of the trolley wires which corresponds with the track upon which the car has been directed.

Judge Coxe opens his opinion with a dissertation on electric traction. "Electricity," he says, "has so completely supplanted horse power as a means for propelling street cars that it is difficult to realize that only about 10 years have passed since the first successful electric railway was installed. At the present time there are more than 500 roads in operation, employing an immense army of workmen, and a vast amount of capital. That this wonderful result was accomplished only after innumerable difficulties and obstacles had been encountered and overcome is manifest. The potentialities of the art attracted a large number of brilliant and ingenious men, who for more than a decade have been laboring to make electric railroading successful. Even after the necessities of the situation had evolved the fundamental principle of taking the electricity from an overhead conductor, the difficulties in finding suitable contact and switching devices for a long time prevented commercial success, and the solution of the problem taxed the ingenuity of a large number of inventors."

He next gives a personal estimate of Van Depoele, as follows: "Although the electric road of to-day is a composite organism to which many ingenious and able men have contributed, yet it cannot be denied that to Van Depoele, more than to any other man, belongs the credit of having made it a practical working success. His contributions to the art rapidly supplanted the crude and tentative prior structures and have continued in use until the present time. No one can read this record without being impressed with the truth of this proposition, and this being so the court naturally approaches this controversy in liberal spirit and with an inclination to give the inventor the full fruits of his invention."

The court then takes up the case and refers to the patent as covering devices and combinations by which electric cars are run automatically upon branches and turnouts, the motor being supplied from an overhead system of wires by an under-running trolley pressed up against the wire by a spring or equivalent device, and automatically adjustable to the wire. The other important device in the patent is described as an overhead switch so mounted on the wire that when the forward wheels of the car take the track switch a trend or direction is given to the trolley, so that, when it reaches the overhead switch, it is guided to the proper branch automatically without in any manner disturbing the electric current or the running of the car.

In this way, the court considers, a system is produced which is well nigh perfect in its essential details, and in order to attain this result Judge Coxe believes the record proves that many difficulties had to be surmounted, and many problems solved.

The court decides against the contention of the defendant, that the patent in suit is void because it is covered by earlier patents granted to Van Depoele. Referring to a patent cited, dated Feb. 5, 1889, for which an application was filed Nov. 12, 1888, subsequently to the filing of the application of the patent in suit, the court says that it is manifested on reading the earlier patent, that it was intended to secure a few minor improvements upon the broad invention then pending in the Patent Office. The claims of the earlier patent are declared to be wholly insufficient to secure the invention of the patent in suit, as an infringer, unless he used the peculiar contractions and guide rims shown in the former, would escape all accountability if the latter is held invalid.

The next point taken up is the claim of the defendants that there is no invention in the claims relating to the switching apparatus, because the patentee has simply suspended face downward the well-known form of railway switch. The court holds, that, assuming this to be a fair statement of the Van Depoele achievement, it does not follow that patentability is wanting. When it is considered, it is added, that he was dealing with an under-running system, that it was necessary to shift not only the trolley but the "mysterious current" which the trolley carries, and that he accomplished this result automatically when others failed, it is not difficult to place him above the plane of the mechanic.

The argument of estoppel is next considered. It is based upon the fact that the Sprague Company, from which six cars were purchased in 1890, was absorbed by the General Electric Company in 1892, and that, therefore, the latter by acting as complainant, is violating its obligation to the defendant as purchaser from the Sprague Company. The court decides that the defendant never acquired any right from the Sprague Company, for that company had none to give. If the complainant had in any manner induced the defendant to purchase the cars in question, intimating that they did not infringe the Van Depoele patent, the situation would be different, but as it is, the case seems devoid of every element of estoppel.

The court finds that two claims relating to the construction and attachment of the conductor switch were infringed; also that two claims relating to the directive action of the track switch are infringed; and that one claim relating to the centralizing spring is infringed by one type of trolley in use and not by another type employed.

Pending an appeal to the United States Circuit Court of Appeals, no accounting is ordered, and the injunction against the Elmira road is suspended.

Deaths from Electric Shock.

A southern electrical engineer and station manager sends us an account of two recent deaths from electric shock at Augusta, Ga., with the comment that "If Dr. Goelet's instructions for resuscitation had been promptly resorted to the lives of both men might have been saved." An electrician not in the employ of the electric light company volunteered to fix a street arc which was not burning properly, and while engaged in doing so a green lamp trimmer assisted. In some manner the latter became entangled in the wires and the electrician in attempting to extricate him was also fatally shocked, though not dying until more than an hour later. The other man was pronounced instantly killed and no attempt at resuscitation was made in his case. Both men were colored. The lamp was on a T.-H. 50-arc light circuit, and the ground was wet from a recent rain.

Organization of Eastern Telephone Manufacturers.

A number of telephone manufacturers in New York and New England have been considering the question of forming an association, with headquarters in New York City, to protect their interests, and it is expected that the organization will be effected next week, and will include New York, Boston and Philadelphia manufacturers as well as those in smaller cities included in this territory. Two of the leading independent telephone manufacturers in the East, Mr. H. T. Johnson, of the Manhattan Electrical Supply Company, and Mr. A. F. Stanley, of Stanley & Patterson, New York, are prominent in the movement. The name of "Eastern Telephone Manufacturers' Association" has been considered and may be adopted when the organization is definitely consummated.

The B. & O. Electric Locomotive.

The B. & O. electric locomotive again demonstrated on Friday of last week that it could pull trains through the belt tunnel. Coupled to a freight train of 14 cars, a steam locomotive and caboose, the electric locomotive went through the tunnel at the rate of 18 miles an hour. The train was made up of three gondolas loaded with sand, a tank car filled with water and derrick cars loaded with ballast. To secure resistance measuring up to that to be encountered in hauling regular freight trains, the brakes on the last five cars were set. The deposit of rust in the electric conduit, which caused the stoppage on Monday a week, when a train of 24 loaded coal cars was being taken through the tunnel, has been removed, and no further trouble is anticipated from this source. The electric locomotive may now be put into active service at any day hauling all the freight trains of the B. & O. through the tunnel. It is expected that the two additional electric locomotives which have been built will arrive within four or five weeks.

Central Station Fires in London.

The year 1895, says the London *Electrician*, seems destined to be written in letters of fire in the annals of electric lighting in London. Early in February there was a serious fire at the Kensington Court station of the Kensington & Knightsbridge Electric Lighting Company, and on Monday evening, June 24, the Metropolitan Electric Supply Company's station in Sardinia Street was practically destroyed by fire. The flames burst out with great suddenness in the upper floors about 6.15 o'clock in the evening, and the fire spread with the utmost rapidity, notwithstanding the streams of water from the hydrants fitted to the premises. The interruption of the supply of the district served by the station was, however, only of short duration, thanks to the energy and good will of the staff. By 8.30 most of the theatres and other important buildings in the neighborhood of the Strand were lighted as usual from the Metropolitan Company's remaining stations, and by the latter part of the week it was anticipated that current would be available to every one as usual. No lives were lost and no secondary accident, beyond the bursting of a steam-pipe, was caused by the conflagration. The cause of the fire is still unknown. The catastrophe could scarcely have happened at a more awkward time, and the company is congratulated on so quickly getting a supply to its more important customers. The *Electrician* hopes that these two disasters will bear fruit in more elaborate structural and mechanical precautions against fire.

London Central Station Statistics.

The London *Electrician* in a recent issue publishes a table of statistics relating to the London electrical supply business in 1894, from which the data of the accompanying table are abstracted. In the original table 12 electric lighting companies are represented, but no returns are made by one of these and the data of the other refer to the year 1893. From further information contained in an editorial on the subject, we learn that the total outlay of the London stations increased by 11 per cent. during the year 1894, while the increase in total output was nearly 39 per cent. The total expenditures increased by 22 per cent., but the increase in the total income amounted to 30 per cent.

Companies.	Capital Expended.	Percentage Division of Cost.						Kilowatt-hours supplied during 1894.	Price of Kilowatt-hour during 1894.	Ratio of Expenditures to Receipts.	Total Expenditure per Kilowatt-hour sold.	Percentage Division of Total Expenditures.				Percentage Division of Operating Expenses.			
		Lands.	Buildings.	Plant.	Mains.	Meters.	Miscellaneous.					Operating Expenses.	Distribution.	Management.	Rents, Rates, Taxes, etc.	Coal.	Oil, Waste, etc.	Salaries and Wages.	Repairs and Maintenance
									cts.	p. ct.	cts.								
1. Charing Cross and Strand Electricity Supply Corporation	$1,058 810	97.2				1.25	1 55	1,115,609	12 & 10	57.6	6.08	67.0	5.02	10.4	17.4	50.7	6.44	20.6	22 1
2. Chelsea Electricity Supply Co	598,500	.45	11 8	44.2	27 9	3.53	12.0	469,216	16	47.6	7.56	53 8	7.36	24.6	14.0	52.2	8.86	24 9	14.2
3. City of London Elec. Lighting Co	4,947,270	9.90	12 0	29.3	31.4	1.47	16.0	2,525,217	16 & 8	51.0	6 48	67.1	13.9	9.30	9.61	62.3	9 97	27.6	8 98
4. House-to-House E. L. Supply Co.	419,240	.....	12.2	42.2	28 7	5.28	11.3	400,911	16 & 10	54.2	8.80	72 7	3.40	16.2	7 40	52.3	12.3	29 3	11 6
5. Kensington & K'bridge E. L. Co.	987,370	4.96	9.07	32.0	37.1	3.62	13.0	977,797	16 & 12	66.0	8.40	43.3	6 97	11.5	37.5	39.5	7 97	26 5	26 2
6. Metropolitan Electric Supply Co.	3,144 600	1 96	21.9	39 4	24 8	2.27	9.47	2,637,267	14 1-2	74.2	11.52	66.8	0.79	13.2	19.1	54.8	8.93	20.3	15.8
7. Notting Hill Electric Lighting Co	391,670	9 40	14.0	19.3	49 4	1.94	5.83	130,266	16	53.1	10 02	56.0	4.11	26.8	21.3	34 5	8 48	26 6	30.1
8. St. James & Pall Mall E. L. Co.	1,155,330	21 10	15 9	26.4	25 3	4 23	7.03	1,569,884	12	62.8	7 16	50 1	3.79	14.1	27 5	41.8	7.19	38.4	12 4
9. St. Pancras Vestry	549,600	9.86	9.99	33 1	36.2	3.37	7.32	719,484	12 & 6	57.2	6.46	63 6	13 1	10.8	12 3	48.2	7 44	27 1	17.2
10. Westminster Electric Supply Co.	2,055,000	4.13	18 4	26.7	42 2	4.94	3 42	2,173,298	12 & 8	57.1	6.64	49.4	2.94	20.3	27.1	39 1	8.24	42.6	9 92

All of the companies have a depreciation account of one kind or another, the amount deposited to its credit varying from 1 to 4 per cent. of the amount of money expended on the respective plants.

In turning English money into dollars and cents, the pound was taken at $5 and the penny at two cents. The table as printed in the London *Electrician* contains columns giving, besides the percentages for each item, the actual corresponding amounts of money, and a third column expressing the various expenditures in pence per kilowatt-hour sold during the year.

Man as a Machine from an Electrician's Standpoint.

If the human heart be considered as a pump it can be shown that it does 124 foot-tons of work in 24 hours; the work spent by the muscles in breathing amounts to about 21 foot-tons in 24 hours. If these figures, which are given in a contemporary, are correct, a few interesting, though otherwise useless, deductions from them may be made. The power of operating the heart is then equivalent to 3.89 watts and that of the lungs to 0.66, making a total of 4.55 watts. This amount of power would develop a light of about two candles in an incandescent lamp; a man is therefore continually, day and night, doing an amount of work necessary to keep him alive at a rate equal to that in a 2-cp incandescent electric lamp. If the luminous efficieney (or better, inefficiency), of the incandescent lamp is 5 per cent., this amount of power if converted into cold light would represent 40 candles which would make every man, wise or otherwise, a shining light, and would supply all the light necessary for him to live without artificial lighting; or, in other words, if he had some organ similar to that in the fire fly, he could, by exerting the same power as it takes to operate his heart and lungs, surround himself with a flood of light. As man power is usually rated as about one eighth hp, which is equal to 93.3 watts, his efficiency, when "fully loaded," considering only the internal losses, would therefore be about 95 per cent., which is remarkably high, especially when we consider that he is supposed to have been designed many thousand years ago, and to have been degenerating ever since. But this does not take into account that both heart and lungs will work much harder when he is performing external work; the good result is, therefore, only apparent and not real. Nevertheless, some men are most efficient when doing treadmill work. As we do not know the foot-pound equivalent to the food which he eats, nor the amount, it is not possible to carry these useless figures any further. It is of interest, however, to note in this connection, that Prof. Thurston considers man a very efficient machine, by which, we suppose, he means as a converter of the energy of food into mechanical power.

The Third Convention of the Northwestern Electrical Association.

THE third semi-annual convention of the Northwestern Electrical Association and the eighth meeting of the body since its organization at Marienette, Wis., August 19, 1892, is the first held outside of the territory to which its activity has heretofore been restricted, but there is no reason whatever to believe that its success will thereby be affected. The committee on entertainment, consisting of Messrs. Morse, Bunce, Wolff, Valentine and Gregory, have been indefatigable in their efforts to insure that the Chicago meeting shall mark still another step in advance, and there is every promise that such will be the case. We print below a programme of the meeting, with a complete list of officers and committees, and biographical sketches of the officers and directors. In another column will also be found a history of the association since its organization.

The following is the programme of the Chicago meeting, to which, however, some additions may be made.

WEDNESDAY.

Morning.—Roll call at 9 a. m., followed by presidential address and report of committees. The following papers will then be read and discussed:

"Central Station Economy," by J. S. Stephens.

"Electrical Influence," by A. V. Abbott.

Afternoon.—A visit will be made to the Harrison Street Edison plant and to the power house of the Metropolitan Elevated Electric Railway, the party starting from the hotel at 2 p. m.

THURSDAY.

Morning.—The meeting will be called to order at 9 a. m., and the following papers read and discussed:

"Boiler Feed Waters and Their Treatment," by W. D. Jameson.

"Electric Street Lighting," by George Cutter.

Afternoon.—At 2 o'clock a trip in a special train will be made along the drainage canal as far as Joliet.

Evening.—The local committee has made arrangements for a theatre party to the Columbia Theatre, where the "Merry World" is on the boards.

FRIDAY.

Morning.—The following papers will be read and discussed:

"The Choice and Testing of Transformers," by Prof. D. C. Jackson.

"Boilers and Practical Specifications for Building the Same," by Jno. C. McMynn.

Afternoon.—A drive will be taken through the parks.

Officers: First vice-president, George Grimm; second vice-president, Pliny Norcross; secretary, Wm. Goltz; treasurer, John Schuette. Directors, F. A. Copeland, O. M. Rau and E. M. Highlands.

Committee on Legislature.—I. P. Lord, C. D. Wyman, John Schuette and G. L. Cole.

Committee on Schedule of Rates.—Geo. A. Davis, Geo. Farwell and P. H. Korst.

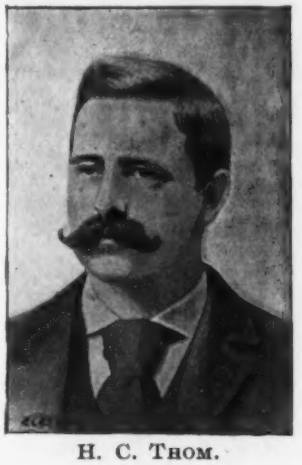
Committee on Transportation.—M. J. Sullivan, W. W. Low and F. Overbagh.

Committee on Board of Underwriters.—Pliny Norcross, O. M. Rau and Wm. Goltz.

Committee on Entertainment.—S. F. B. Morse, A. C. Bunce, J. B. Wolff, John Valentine and Chas. E. Gregory.

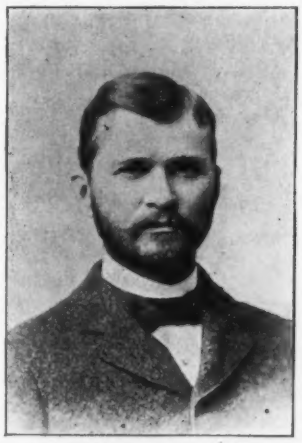
The absence of Mr. H. C. Thom from the presidential chair will be a matter of the deepest regret to those in attendance at the meeting. By his death, which occurred March 16, the association lost one of its most energetic and prominent members, who was ever willing to turn aside from his many business interests to assist in its advancement. The early manhood of Mr. Thom, who was born in 1856, was spent in educational pursuits. Shortly after his graduation from the Oshkosh Normal School, in 1879, he became principal of the schools of that city, which position he occupied for five years; subsequently he served two terms as superintendent of schools in his native county, Rock County, Wis., where he had purchased a dairy farm, and was a member of the Wisconsin educational committee at the World's Fair.

Mr. Thom took an active interest in public matters, having been twice elected chairman of the Wisconsin Republican State Committee, and served as a member of the Rock County Board of Supervisors. He had also been president of the National Dairy Commissioners' Association and served two years as a State Food and Dairy Commissioner. A large stockholder and secretary and manager of the Four Lakes Light & Power Company of Madison, Wis., he took a lively interest in everything electrical, and was one of the founders of the Northwestern Electrical Association, of which he was elected secretary in January, 1894, and president at the January meeting of this year.



H. C. THOM.

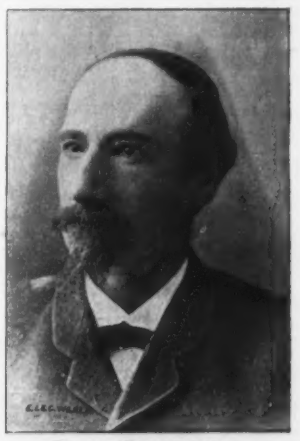
George Grimm, second vice-president, was born at Jefferson, Wis., Sept. 11, 1859. Mr. Grimm is a lawyer by profession, with a good practice and a splendid reputation. He has been a member of the State legislature, and active in politics for many years. In 1893 he organized the Jefferson Electric Company and has since been its president and manager. Three times previously attempts have been made to introduce electric lighting in the city, but each time the effort failed. Mr. Grimm's energy and tact promptly secured the necessary capital and support, and the company has been upon a good paying basis and given complete satisfaction to its patrons since its organization. Although Mr. Grimm devotes most of his time to his law practice, he is a keen student of all matters necessary to secure the continued success of his last venture, and few station managers will be found possessing more knowledge of all the details of practical station management.



GEORGE GRIMM,
First Vice-President.

Mr. Pliny Norcross, second vice-president, is proprietor of the Janesville, Wis., Electric Light Company and one of the most progressive electric lighting men of the West. The Janesville plant was started by him seven years ago, and so successfully managed that its capacity has since been more than doubled, and we understand that another considerable increase will soon be necessary. In this case, as Mr. Norcross is always up with the times, it is most probable that his city will be one of the first in the West to profit from the very latest advances in electrical science. A paper from his pen on "Hints upon Daily Work about a Dynamo Plant" formed one of the important contributions at the January meeting of the association.

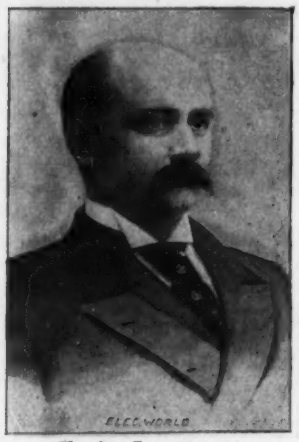
WM. GOLTZ,
Secretary.



JOHN SCHUETTE,
Treasurer.

Mr. Wm. Goltz, secretary, commenced his electrical career in this country with the Edison General Electric Company in St. Paul

and later in Minneapolis. When the consolidation took place between the Thomson-Houston and Edison companies, he resigned his position, and in April, 1894, started the well-known firm of Goltz & Sinclair of Milwaukee. Mr. Goltz has been untiring in his efforts to forward the interests of the association, and much of the success of the Chicago meeting will be due to his preparatory work.



F. A. Copeland,
Director.

To Mr. John Schuette, treasurer, the handling of funds is no novelty, as he is one of the most prominent bankers in the State of Wisconsin. Notwithstanding the many calls on his time, he takes a great interest in electricity, and is owner of the Manitowoc electric plant and has given many valuable suggestions to his central station brethren.

Mr. F. A. Copeland, director, is very well known in politics and could have had the nomination of lieutenant-governor of the State of Wisconsin at the last election. He has been for years deeply interested in the large number of saw mills in his section of the country, and is president of the Edison Illuminating Company of La Crosse, Wis. This plant was started in 1887, with the expectation of getting about 2,000 lights, and Mr. Copeland was given carte blanche to put in what he thought would be necessary. Very wisely considering that it would be easier to raise funds on the start than to increase in a year or two, he put in a plant that would be able to take care of five or six thousand lamps. The result is that at present there are 12,000 lamps wired, and two 75-kw direct-connected machines are being added, principally, however, to keep step with modern improvements, and to have a duplicate set rather than from actual need of current. In the eight years' running, continuous day and night, the plant has been shut down but three times, the longest delay having been just seven minutes.

O. M. Rau,
Director.

E. M. Highlands,
Director.

Mr. O. M. Rau, director, began his electrical career with the Daft Electric Light Company of Greenville, N. Y. After having filled several responsible positions in the East, he came west three years ago to take the office of electrician to the Edison Electric Illuminating and Milwaukee Street Railway companies, both of which he now holds. Not only is Mr. Rau a most successful electrician but also a patentee, many of his devices for overhead appliances being in use on the trolley roads throughout his State and elsewhere.

Mr. E. M. Highlands, director, is the youngest official of the association, having been born at Alliance, O., in 1874. After a two years' course at Curry University (Pittsburg, Pa.), he started into practical engineering by working on the Muncie and Mt. Vernon, Ind., and Braddock, Pa., gas and water works, and then spent two years in the office of the American Water Works & Guarantee Company at Pittsburg. In 1890 Mr. Highlands went to Clinton, Iowa, and after being employed on the water works there for a year became superintendent of the Lyons, Ia., Gas & Water Works, being the youngest gas and water superintendent in the United States at the time. Later he became manager of the Clinton, Ia., gas and electric plants, which position he now holds. Mr. Highlands is also known as a technical writer, a contribution from his pen having opened up the Welsbach gas-light controversy.

Uses of Accumulators.

BY J. S. WEBSTER.

Mr. Howell's paper with the above title, printed in the London *Electrical Review* of May 24 and 31, and noted in the Digest of June 15, is a timely and valuable contribution to electrical literature, and is worthy of careful study by all who are interested in the general improvement of electrical service. While the object of this paper is to demonstrate the adaptability of accumulators to large central stations, the data given can be practically applied to a wide range of circumstances. For instance, the statement is made that an accumulator added to a residence plant operated by gas or gasoline engine has in some instances effected a saving of over 50 per cent. in fuel and furnished continual service as compared with a ten-hour service from engine. This is easily comprehended when we consider that the ordinary plant is seldom operated at more than a fourth to half its capacity, and that when the load factor is so small the fuel consumed per unit of output is nearly three times as great as when operating at highest efficiency. When a plant is operated at a fifth of its capacity, about the same amount of fuel is required to overcome mechanical friction as is utilized to supply the current. We do not forget that our storage system also operates at lower efficiency with very light load, but the energy necessary to overcome resistance is small when compared with that necessary to overcome friction.

Economy can hardly be considered the main object of the accumulator in residence lighting, as those who are able to purchase their own plants will not be likely to consider the slight operating expense of same. This, of course, does not apply to plants propelled by steam. A steady light and an always available service are the recommending features of the accumulator, and when we couple these with economy of operation, it is not easy to comprehend how any person wanting first-class service can hesitate to avail himself of these features when the small outlay is not prohibitory, and when the accumulators will be installed by firms of the highest responsibility under a guarantee of low cost of maintainance for a term of years.

The data submitted by Mr. Howell will be amplified when applied to electrical railway practice, where the fluctuations of load are so sudden and of such short duration that not only does the mechanical system operate with low fuel economy, but the excessive strain renders it necessary to equip the station with apparatus of abnormal strength and capacity. The mechanical plant is not capable of maintaining a constant potential, which results in fluctuating lights (in evening) and low economy of motor service. The success of recent application of accumulators to railway service demonstrates that the above obstacles are quite satisfactorily overcome by their adoption.

Machinery of special design becomes unnecessary when coupled with accumulators, and if all these points are given due consideration beforehand, the equipment of an economical station, embodying the most desirable features, does not require so much outlay as is often expended upon stations that have failed to pay dividends.

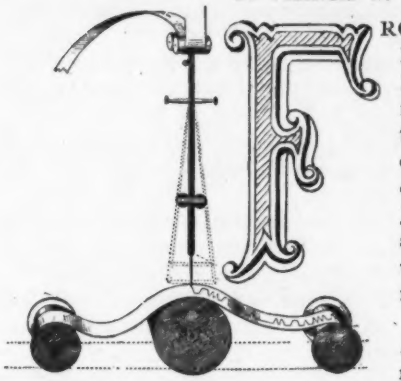
When we consider that in central stations, and even in railway practice, a fourth of the plant is simply used as a reserve, and only renders service a few hours a day—sometimes being idle for weeks—we are not surprised to find no dividend at the end of the year. This might, upon first thought, seem to apply equally to accumulators, but it does not. Accumulators work at high economy on comparatively low rates of discharge, and are able to handle excessive loads for short periods in a creditable manner. The engines of large units are operated at their highest efficiency about three fourths of the day, and all extremes taken care of by the accumulators.

A Professor Wanted.

At a recent meeting of the Syndicat Professional des Industries Electriques, at Paris, the president reported that he had received no applications for the post of Professor of Practical Electricity at the Ecole Diderot, and expressed the opinion that the lack of candidates was due to the fact that the salary offered—83 francs per month for 12 hours of class work weekly—was too small.

The Invention of the Electromagnetic Telegraph.—I.

BY FRANCIS W. JONES.



FROM letters published in THE ELECTRICAL WORLD of June 16, 1894, and in other journals of recent date, it appears that there is a wide diversity of opinion as to the amount of credit due respectively to Joseph Henry, S. F. B. Morse, and Alfred Vail, for the invention of the electromagnetic recording telegraph.

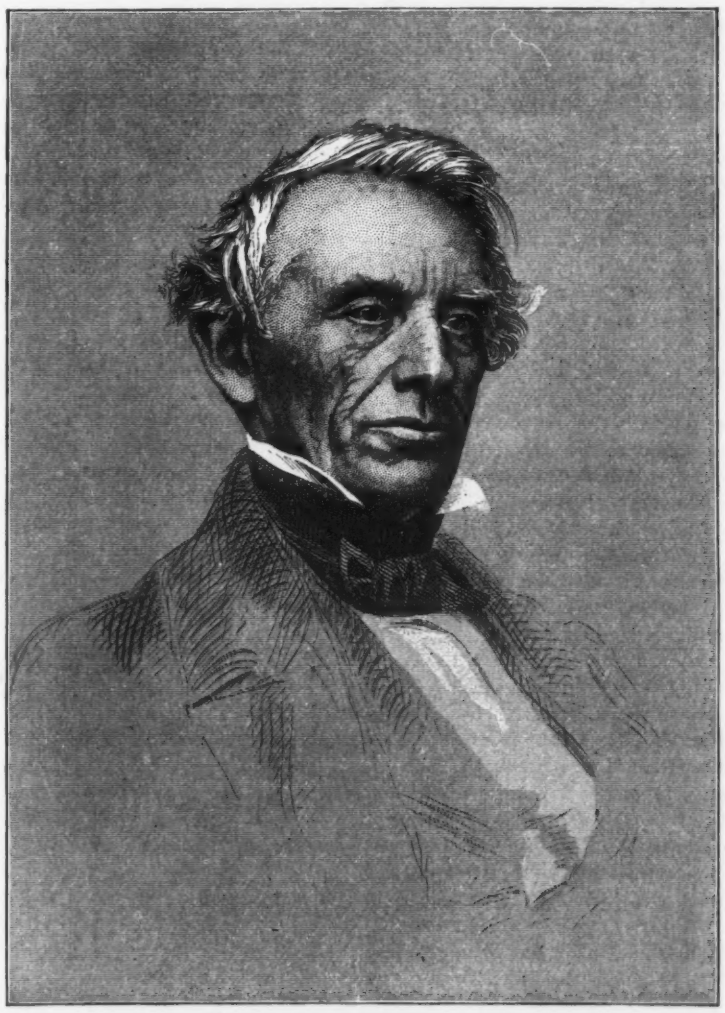
Mr. Stephen Vail, son of Alfred Vail, says: "I have no desire to detract from the credit due Morse, Henry or any other of the many scientists who have contributed more or less to that which now constitutes the Electric Telegraph, but I do feel that the very important part taken by Alfred Vail has never, either at the hands of Morse or the world, received the consideration due it." (Vide THE ELECTRICAL WORLD, June 16, 1894.)

Mr. Edward L. Morse, son of S. F. B. Morse, says: "That Alfred Vail rendered most valuable technical and financial assistance to Prof. Morse, those who know anything about the birth of the telegraph would never dream of denying. That he and Prof. Henry were the '*sole*' inventors of the telegraph of to-day is a preposterous statement." (Vide THE ELECTRICAL WORLD, June 16, 1894.)

Mr. James D. Reid, United States Consul at Dunfermline, Scotland, a superintendent of the very first Morse telegraph wires, and who has been ever since a close friend and ardent admirer of Prof. Morse, says: "Henry never claimed and could not claim the telegraph as, in any sense, his own, and as to Alfred Vail, whom I knew well, and who has of late years been held up as the true parent of the telegraph, he simply hired himself at $3 a day to put into mechanical shape and workable form the already completed and successfully and publicly exhibited mechanism of the Morse telegraph. There was nothing left to invent." (Vide the *telegraph Age*, Oct. 1, 1894.)

Mr. Franklin L. Pope, in a carefully prepared article, conspicuous for its lucidity and wide scope, says: "It is self-evident, therefore, that not a single feature of the original invention of Morse, as formulated in his caveat and repeated in his original patent, is to be found among the essential constituents of the modern apparatus. Prior to 1837 it embodied the work of Morse and of Henry alone. From 1837 to 1844 it was a combination of the inventions of Morse, Henry and Vail; but as we have seen, the elements contributed by Morse have gradually fallen into desuetude, so that the essential telegraph of to-day and the universal telegraph of the future comprises solely the work of Joseph Henry and Alfred Vail. The grandeur of Vail's conception of an alphabetical code based on the elements of time and space, has never met the appreciation which it deserves." (Vide the *Century Magazine*, New York, April, 1888, page 943.)

In the face of the above quotations it can hardly be said that the subject is a "dead issue"; on the contrary, with those to whom the inventors were near and dear, it seems a burning question. My object in this connection is to attempt to place a few facts bearing on the matter in their natural order as briefly as possible before your readers; trusting that some of the parties more deeply interested may be able to supply some missing links which at present cause much perplexity. I am perfectly assured that all intelligent and fair-minded persons of the electrical profession at least, will not hesitate to yield full credit and honor in proper proportions to the great minds that have made such a valuable contribution as the electric telegraph, to the comfort and prosperity of the human race.



AS MORSE APPEARED IN 1832.

The New York *Journal of Commerce* on Sept. 7, 1837, says: "We have received the following note and diagram, with the explanation of the latter, from Mr. Morse:

" 'Gentlemen: You had the kindness to assert, a few days ago, my claim to the invention of the electromagnetic telegraph, for which I thank you. As to the priority of my invention, entirely planned and for the most part executed as it was nearly five years ago, I can adduce the amplest proof.

" 'You announced that I was preparing a short circuit, to show to my friends the operation of the telegraph. This circuit I have completed, of the length of 1,700 feet, or about one third of a mile; and on Saturday, the 2d inst., in the presence of Professors Gale and Torrey, of this city, and Professor Daubney, of the Oxford (English) University, and several other gentlemen, I tried a preliminary experiment with the register. It recorded the intelligence sufficiently perfect to establish the practicability of the plan, and the superior simplicity of my mode of communication over any of those proposed by the professors in Europe.

" 'It will be observed that no account has reached us that any of the foreign proposed electric telegraphs have as yet succeeded in transmitting intelligible communications; but it is merely asserted of the most advanced experiment (the one in London), that "by means of five wires," etc., intelligence "*may be* conveyed." I have the gratification of sending you a specimen of the writing of my telegraph, the actual transmission of the communication made this morning, in a more complete manner than on Saturday, and through the distance of one third of a mile.

" 'Thinking it may be gratifying to your readers to see the kind of writing which it performs, I have had it engraved for you, accompanied with an explanation.' "

The letter is dated N. Y. City University, Sept. 4, 1837.

" Specimen of telegraphic writing made by means of electricity at the distance of one-third of a mile. (See Fig. 1.)

"The *words* in the diagram were the intelligence transmitted.

"The *numbers* (in this instance arbitrary) are the numbers of the words in a telegraphic dictionary.

"The *points* are the markings of the register, each point being marked every time the electric fluid passes.

"The register marks but one kind of mark, to wit: (V). This can be varied two ways. By intervals, thus: (V VV VVV), signifying one, two, three, etc., and by reversing, thus (Λ). Examples of both of these varieties are seen in the diagram. The single numbers are separated by *short*, and the whole numbers by *long inter-*

vals. To illustrate by the diagram: the word 'successful' is first found in the dictionary, and its telegraphic number. 215, is set up in a species of type prepared for the purpose, and so of the other words. The type then operates upon the machinery, and serves to regulate the times and intervals of the passage of electricity. Each passage of the fluid causes a pencil at the extremity of the wire to mark the points as in the diagram.

"To read the marks, count the points at the bottom of each line. It will be perceived that two points come first, separated by a *short* interval from the next point. Set 2 beneath it. Then comes one point, likewise separated by a *short* interval. Set 1 beneath it.

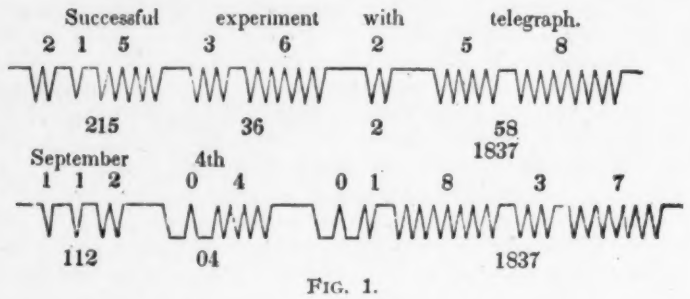


FIG. 1.

Then come five points. Set 5 beneath them. But the interval in this case is a *long* interval; consequently the three numbers comprise the whole number, 215.

"So proceed with the rest, until the numbers are all set down. Then by referring to the telegraphic dictionary, the words corresponding to the numbers are found, and the communication read. Thus it will be seen that by means of the changes upon *ten* characters, all words can be transmitted. But there are *two points* reversed in the lower line. These are the *eleventh* character, placed before a number, to signify that it is to be read as a number and not as the representative of a word."

The foregoing, from the New York *Journal of Commerce*, clearly describes the system Mr. Morse had developed on Sept. 2, 1837. The original apparatus is in the custody of the Western Union Telegraph Company, New York City, and is shown in Fig. 2, and described in Shaffner's "Telegraph Manual" as follows:

"Morse's first instrument was made of an old picture frame (Fig. 1), fastened to a table. The wheels of an old clock, *D*, were arranged to carry the paper forward by the endless board connecting *D*, with the cylinder axle *C*. The weight *E* put in motion the clockwork. *A* is a cylinder on which rolls the ribbon paper, and *B* is an auxiliary drawn in the movement of the paper.

"The paper unrolls from *C*. The pen lever suspended from *F* is composed of two diverging rods connected by two cross pieces at *g*, and at *h* is a steel bar to serve as an armature to the electromagnet at *h*, the ends of which face the armature. The wire runs from the battery *I* to the magnet coils, thence to *K*, and from *J* back to the battery. When the battery is in action, the magnet *h* attracts the armature *F h g*. When the circuit is opened a spring draws the pen lever from the magnet. The pencil adjusted in the base of the lever. When the magnets attract, the lever makes a mark on the paper, and if the paper is in motion the mark will be oblique across, forming the half of the letter V.

"*L L* are the two cylinders upon which is an endless band, movable by a crank. *O O* is the circuit lever, *N* its fulcrum and *P* a weight to bear down that end of the lever. *J K* are two small cups filled with mercury. When the fork is made to descend into the mercury cups, it closes the metallic circuit and the electricity flows through the wires, the magnet spools, and then to the battery. *M* is a port rule. It is filled with the type represented in Fig. 2. These type are movable, but they fit solid in the port rule. When the crank is turned, the projection of the type presses under the subtending piece attached to the lever *O O*, which raises it at that end, and so that the forked ends enter the mercury in the cups *J K*. After the first type has passed the hanging projection *O*, the lever is elevated from the mercury cups."

It was on the occasion of the exhibition in the University Building, New York City, on Sept. 2, 1837, as chronicled in the *Journal of Commerce*, that the Morse telegraph, above described, was seen for the first time by Alfred Vail, who then ascertained that Morse needed capital and mechanical aid, in order to secure new and improved apparatus and to proceed with his experiments. Vail undertook to furnish this aid, receiving therefor a promised share in the invention. Prior to this event, and on the 3d of February, 1837, the House of Representatives passed a resolution requesting the Secretary of the Treasury to report upon the propriety of establishing a system of telegraphs.

A circular of inquiry to numerous scientific and practical individuals in different parts of the United States was addressed by the Secretary.

Amid the suggestions thus elicited, a plan for an electromagnetic telegraph was communicated by Morse in a letter dated Sept. 27, 1837, in which he says:

"About five years ago, on my voyage home from Europe, the electrical experiment of Franklin, upon a wire some four miles in length, was casually recalled to my mind in a conversation with one of the passengers, in which experiment it was ascertained that the electricity traveled through the whole circuit in a time not appreciable, but apparently instantaneous.

"*It immediately occurred to me, that if the presence of electricity could be made visible in any desired part of this circuit it would not be difficult to construct* a system of signs *by which intelligence could be instantaneously transmitted.* The thought, thus conceived, took strong hold of my mind in the leisure which the voyage afforded, and I planned a system of signs, and an apparatus to carry it into effect. I cast a species of type, which I had devised for this purpose, the first week after my arrival home; and although the rest of the machinery was planned, yet, from the pressure of unavoidable duties, I was compelled to postpone my experiments, and was not able to test the whole plan until within a few weeks. The result has realized my most sanguine expectations.

"As I have contracted with Mr. Alfred Vail to have a complete apparatus made to demonstrate at Washington by the 1st of January, 1838, the practicability and superiority of my mode of telegraphic communication by means of electromagnetism (an apparatus which I hope to have the pleasure of exhibiting to you), I will confine myself in this communication to a statement of its peculiar advantages:

"A series of experiments to ascertain the practicability of this mode, I am about to commence with Prof. Gale, of our university,

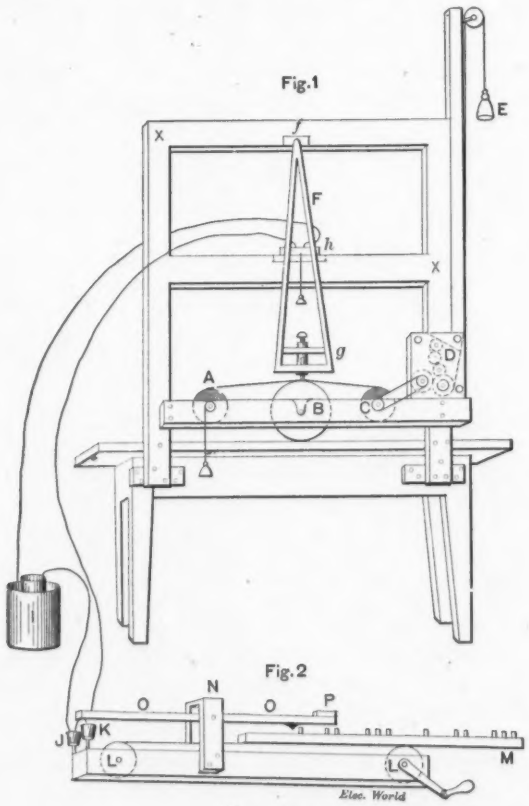


FIG. 2.

a gentleman of great science, and to whose assistance, in many of my late experiments, I am greatly indebted.

"The cost of printing, in the first instance, *of a telegraphic dictionary*, should perhaps also be taken into account, as each officer of the government, as well as many others, would require a copy, should this mode of telegraphic communication go into effect. This dictionary would contain a vocabulary of all the words in common

use in the English language, with the numbers regularly affixed to each word."

On Oct. 6, 1837, Prof. Morse filed in the Patent Office a caveat in which he claims:

First—A system of signs by which numbers and consequently words and sentences are signified.

Second—A set of type adapted to regulate and communicate the signs, with cases for convenient keeping of the type, and rules in which to set up the type.

Third—An apparatus called a port rule, for regulating the movement of the type rules, which rules, by means of the type, in their turn regulate the times and intervals of the passage of electricity.

Fourth—A register which records the signs permanently.

Fifth—A dictionary or vocabulary of words numbered and adapted to this system of telegraph.

No allusion whatever is made up to this time in this caveat or elsewhere of the dot-and-dash alphabet shown in his application for a patent, dated six months later.

On the 7th of April, 1838, Morse subscribed to an application for letters-patent in the United States, granted June 20, 1840, in which he describes and claims, not only various combinations of marks to represent numerals, which in turn were to be translated into words by a specially prepared dictionary, but also a system of signs of letters, consisting in variations of the dots, marks, and dots and lines, and spaces of separation.

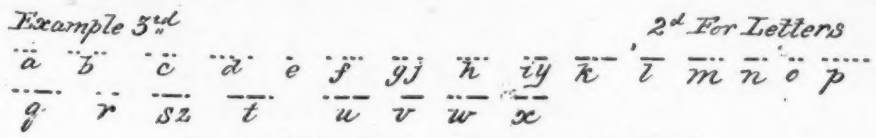


FIG. 3.—MORSE CODE AS SHOWN IN 1840 PATENT.

This code, reproduced in fac-simile from the Morse patent of 1840, is shown above.

The characters are duplicated in three cases, viz., *G* and *J*, *I* and *Y*, and *S* and *Z*. The method of transmission was by the well-known port rule and metallic type, whose edges were notched to represent the characters and transmitted them automatically.

The register shown for recording is the same in principle as the modern instrument. (See Fig. 2.) At the end of the lever opposite to the armature end was inserted "one or more pencils, fountain pens, printing wheels, or other marking instruments," as shown in Fig. 4 of the said patent drawing. Nothing is mentioned in this patent, nor in the reissue No. 79, of Jan. 15, 1846, to indicate that signaling could be effected by hand. Only the port rule and type method is shown, but in a second reissue, No. 117, of June 13, 1848, this specification is changed to say "and the closing and breaking of the circuit may be effected by applying the hand or any other machinery to the signal lever, or by any other mode adapted to the same end." On Aug. 18, 1838, Morse applied in France for a patent, the specification of which was substantially the same as his United States specification of April 7.

In 1845 a book was issued from the Philadelphia press of Lea & Blanchard, entitled "The American Electromagnetic Telegraph," with the reports of Congress on the Morse system, and a description of all telegraphs known by Alfred Vail. The work is prefaced by the following interesting "Introduction," over Vail's signature, and dated Washington, D. C., Aug. 18, 1845:

"The propriety of presenting to the public a work of this character seemed desirable, from the frequent calls made upon the author for some accurate and full description of the American Electromagnetic Telegraph, which might assist to an intelligible comprehension of the principles upon which it is based, and the mode of its operations, as well as descriptions of those plans now in operation in Europe. In the execution of this task it has been his determination to spare no labor, and to omit nothing that could enable those who had never seen the operation of the telegraph, to obtain a full understanding of the subject, and also judge for themselves of the merit of the American invention as compared with those of Europe. For this purpose 81 wood cuts are introduced to illustrate this and collateral subjects.

"The various reports of Congress, which have been made from time to time, as the subject of the Electromagnetic Telegraph has been presented to them, have been embraced in the work. They contain much information in relation to the origin and progress of the invention, as well as other useful matter. In the closing part of the work is given a synopsis of the early discoveries in electricity; the experiments of Franklin, and also the discoveries of ingenious and scientific gentlemen of the present day. The principal part, however, is devoted to a full and complete description of the various plans of telegraphic communication, by means of electricity and galvanism, in the chronological order of their invention; by which it will be seen, that for priority as well as originality, America has the pre-eminence, not only at the time of the invention but up to the present period; nothing having yet been brought forward that fulfills so completely the conditions of what is signified by the term *telegraph*, as that plan invented by Prof. Morse. Some of the foreign plans the author has found extremely difficult to illustrate, without almost reinventing them, so imperfectly and obscurely have they been described.

"The experimental line from Washington to Baltimore has been in successful operation for more than a year, and has been the means of conveying much important information, consisting of messages to and from merchants, members of Congress, officers of the government, banks, brokers, police officers, parties, who by agreement had met each other at the two stations, or had been sent for by one of the parties; items of news, election returns, announcement of deaths, inquiries respecting the health of families and individuals, the daily proceedings of the Senate and House of Representatives, orders for goods, inquiries respecting the sailing of vessels, proceedings of cases in the various courts, summoning of witnesses, messages in relation to special and express trains, invitations, the receipts of money at one station and its payment at the other for persons requesting the transmission of funds from debtors, consultation of physicians, and messages of every character usually sent by mail.

"The author trusts that the work will be received as one of a practical character, and furnish to those desirous to acquaint themselves with the subject, such information as they seek."

(To be continued.)

A Method of Determining Furnace Temperature.

In a recent communication to the Académie des Sciences, M. Berthelot suggests a method of determining the temperature of a furnace, which is based on the fact that the refractive index of gas varies with its density. Two tubes filled with the same gas are taken, and a spectrum refracted through each, the two spectra being observed together. If then one is raised to a high temperature, and its contents allowed to expand, so as to maintain the pressure inside constant, it will be necessary to reduce the pressure in the second tube in order to re-establish coincidence between the two spectra. Preliminary experiments in the laboratory have shown the method to be capable of giving very accurate results.—*London Electrician.*

Trailers Condemned.

The New York State Board of Railway Commissioners has notified the Steinway Railway Company, of Astoria, to discontinue the use of trailers on its line until an official examination of the rolling stock of the road has been made.

Autopsicution.

In connection with the recent execution of the murderer Buchanan, the Rochester *Post-Express* proposed to substitute the word "Autopsicution" for "Electrocution," on the ground that it is the autopsy and not the electricity which is really the cause of the death.

Electro-Matrimonial Terms.

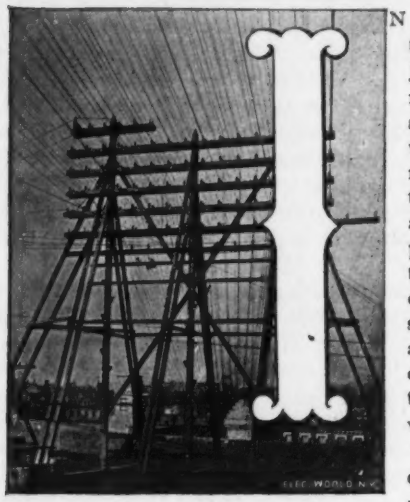
In announcing the marriage of a certain electrical engineer the London *Electrical Review* wished the happy couple a "synchronous career." Quite an appropriate term, but we expect to hear from another London contemporary that this is an unauthorized use of the term, and that it was not adopted by the Congress of 1893, nor even recommended by it.

Not Satisfied with the Whole Earth.

"The Yerkes telescope, they say, will bring the moon within fifty miles of the earth." "That's bad for the moon. The Bell Telephone Company will nab it sure."—*Chicago Tribune.*

Underground Wires in Boston.

BY J. E. TALBOT.



N an act of the legislature of the State of Massachusetts of June 6, 1894, provision was made for the appointment of a *Commissioner of Wires*, whose duty it should be to remove from the streets of the city of Boston or from above such streets, within a prescribed section, all electric wires, cables and conductors and the poles and structures for their support, and cause the owners or users of such overhead conductors to place them underground, with certain exceptions.

Provisions were added clothing the commissioner with suitable powers, and rendering it the duty of the companies affected to comply with the requirements of the act, the purpose of which was to ensure the burying of all wires by the year 1900. This work was to be executed in sections or districts to be prescribed by the commissioner, so much each year. Two districts have been so far prescribed, and within one of these the work has been completed, while in the second it is progressing rapidly; we are, therefore, in a position to give our readers an intelligent idea of the nature and extent of the undertaking. The area within which the provisions of the act apply is bounded by the water front of the city proper, and by a line from water to water along Dover and Berkeley Streets as the southern boundary, which area, for the benefit of those readers unacquainted with Boston, we may roughly describe as a very irregular semi-ellipse of nearly two miles long by one mile wide. The map, Fig. 1, shows clearly the district to be dealt with, which is by no means co-extensive with the municipal limits, but includes practically the commercial business portion of the city.

At the time of the passing of the act certain conductors were already underground, but an enormous quantity of overhead construction demanded the attention of the wire department on its organization in August, 1894.

The first steps taken by Commissioner Murphy, on assuming office, were the prescribing a district in the southeast of the total area affected by the act, to be attacked in 1894, and the establishment of a general system of survey, inspection and enumeration of overhead wires and supports. The 1894 district is shown in detail on the map. In co-operation with the various companies concerned routes were laid out and plans formulated, actual work being commenced in September of that year.

Although the work of placing the wires underground was somewhat tardily undertaken in Boston, as compared with other cities, notably Chicago and New York, nevertheless, this delay has had its advantages in permitting of the avoidance of such systems as have been tried and found wanting elsewhere. It would be beyond the limits of our present purpose to enter into the details of the various methods of underground construction, such as, for example, those having bare conductors supported on insulators and surrounded only by air, the "solid" system with bituminous insulating compound, iron pipes, iron pipes lined with cement, earthenware pipes, wooden pipes, oil insulation under pressure, and many others possessing their respective merits and disadvantages in the direction of cost, flexibility of distribution, rigidity, and otherwise, all of which are more or less familiar to our readers.

Some idea of the magnitude of the extent to which electricity is used in Boston may be derived from the figures furnished by the commissioner, indicating some 6,600 arc lights, 220,000 incandescent lights, and between 4,000 and 5,000 motors, the total electrical horse-power employed daily for electric lighting and power purposes being 28,000. Prior to the compulsory enactments of the 1894 statute not a little underground work had already been executed; the Edison system was almost entirely operated with underground conductors in the manner usual with them, and the telegraph and telephone companies were also operating very largely by underground wires, and in their own conduits.

The companies mainly affected by the provisions of the law were the Boston Electric Light Company, the Suburban Light & Power Company, and the West End Street Railway Company, although a large number of telephone and telegraph wires, and wires for miscellaneous signaling purposes still remained overhead as well.

A comparison of the relative condition of affairs at one point in the 1894 district is afforded by the two following cuts, showing the appearance of the street before and after the change. The bulk of the incandescent lighting and motor service is, naturally, within the affected area (comparable with the district extending from, say, Canal Street to the Battery, in New York) in the hands of the Edison Company, operating three large stations for the supply of that territory, amounting in June, 1894, to 76,800 incandescent lamps and over 4,000 horse-power in motor capacity, beside arc lamps. The Boston Electric Light Company, who contract for the public arc lighting of the city, some 1,600 lamps, also have two large stations within the district, from which they furnish current for commercial arc lights, alternating current, and current for motors. The "Suburban" is another company doing considerable work in the supply of current for these three purposes. The West End Street Railway Company operates what is perhaps the largest and best-equipped electric street railway in the country, and it may be imagined, with its numerous tracks in the narrow and tortuous streets of Boston, that its feed wires and such return wires as were overhead, offered a "shining mark" for the attacks of those opposed to the old conditions of affairs.

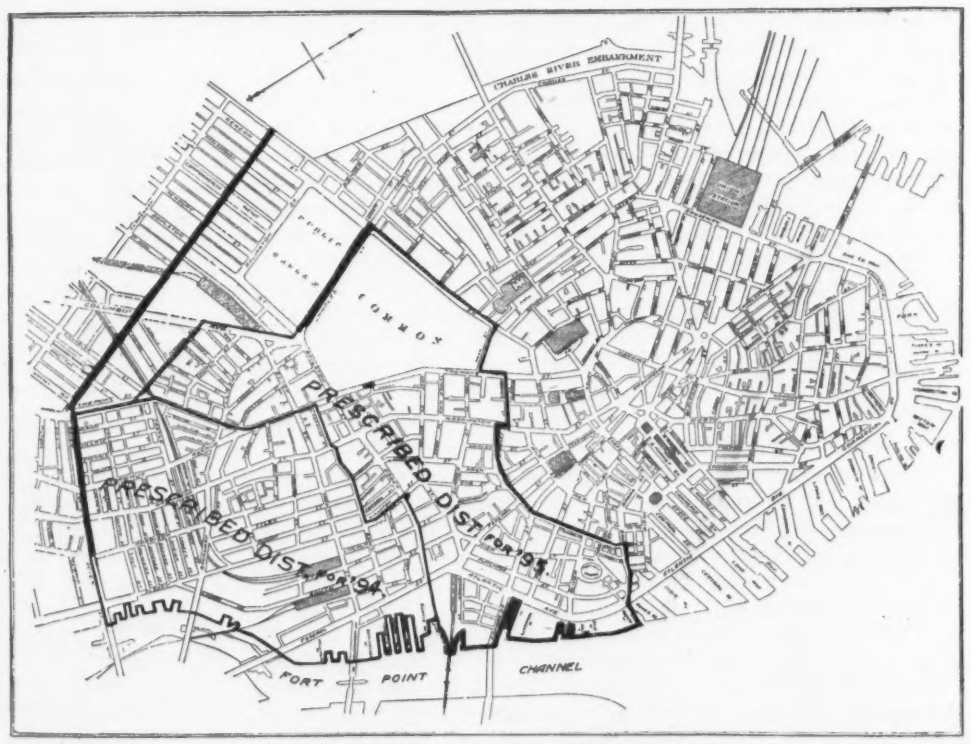


FIG. 1.—MAP SHOWING UNDERGROUND DISTRICTS.

The above companies furnish the major portion of the currents used for lighting and power. The wires of the New England Telephone & Telegraph Company, the Postal Telegraph Company and the Western Union Telegraph Company are all underground in the 1894 district, and very largely so throughout the prescribed area. There are also a large number of smaller organizations and companies operating fire-alarm systems (including the City Fire Alarm Department), district messenger calls, burglar and protective systems and the like, whose wires are rapidly disappearing from sight.

The New England Telephone & Telegraph Company, covering in its operations the city of Boston and outlying districts with ramifications to practically all points of importance in New England, was probably the pioneer, in Boston at least, in any underground construction of importance, and it has continued and extended its system and network of conductors until (we quote from the last annual report) "the length of underground wire in use in Boston at the close of the year was 11,202 miles."

The central exchange in Milk Street is entirely connected by a

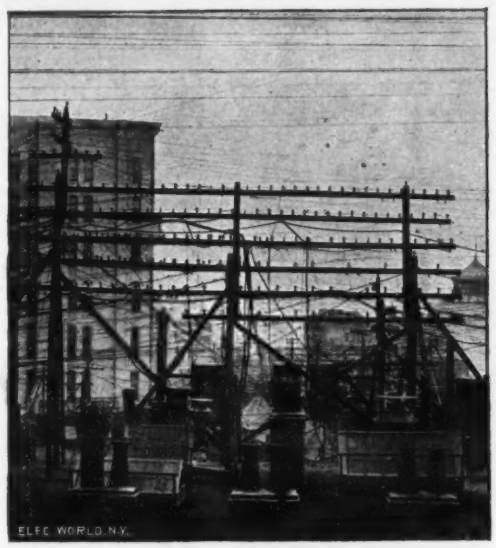


FIG. 2.—WIRES ON GLOBE BUILDING.

symmetrically organized system of underground cables entering the building through the basement and passing upward through a central shaft to the operating room at the top of the building. This exchange and its offshoot in Haymarket Square probably represent the acme of modern telephone construction, but would require an article to themselves to do them justice. The 11,202 miles of wire represent about 30 miles of streets, and over a million feet of duct.

The service is now largely by complete metallic circuit, and new subscribers are almost invariably accepted on this basis.

The initial cut gives an idea of the wires and overhead structure on the roof of the Hathaway Building, these wires being some of the circuits from the Gilbert Place station of the Boston Electric Light Company, and Fig. 2 shows the conditions on the roof of the Globe newspaper building. An almost incredible amount of dead and useless wire has also been removed by the Wire Department and either sold or removed to the public "dumps" (a general jurisdiction over wires being conferred on the commissioner in addition to the strictly "undergrounding" of active conductors), over 3,000,000 feet having already been so disposed of.

That the commissioner and the companies had not been idle during the period from September, 1894 to February, 1895 (the date of the commissioner's report), is evidenced by the fact that at the latter date nearly 400,000 feet of duct had been laid, in much of which circuits were in actual operation. This in the face of an unusually severe winter; with the return of more favorable climatic conditions work has been, and is being pushed with even increased vigor, and it appears not improbable that the interment of conductors will be completed considerably within the prescribed time. The subway proper, or conduit, consists of a number of ducts or pipes made of sheet iron and lined with cement, leaving an opening three inches in diameter; these pipes to the required number are embedded or laid in concrete at a depth varying from three to ten feet below the level of the street, and surrounded by wood as an extra protection. Manholes with iron covers are placed along the line at distances varying from 40 feet to 460 feet, the average being 250 feet, the distance between consecutive manholes being regulated by considerations of convenience, obstructions and grading. The insulated lead-covered cables are drawn through from manhole to manhole, the separate lengths being jointed together in each manhole. These manholes are built of brick and cement, and extend in general a foot below the bottom of the conduit. They average in dimensions six (1.83m), by six by six feet with an eight-inch (20.3 cm) wall, and three inches (7.6 cm) concrete bottom, though in some cases the natural earth is left, through which accumulations of water may "seep" away. Usually, however, tar, tar-paper and concrete are used for protection against water. The general construction of the ducts and manholes used by the different companies is substantially uniform. The New England Telephone & Telegraph Company in scattered and residential districts sometimes employs wooden ducts on the ground of economy, but in most cases the cement-lined iron pipes of the National Conduit Manufacturing Company are employed.

In all cases the system of ducts is graded toward the manholes so as to prevent accumulations of water within the ducts. The wooden conduit or "pipe log" has in the past, for the locations where it has been used, given good satisfaction, specimens taken up after nine years' service remaining in satisfactory working condition. The mechanical protection afforded, however, is surpassed by the cement-lined iron pipe, which is now almost universally employed, and with satisfactory results.

The cables used in the ducts, depending as they do entirely upon their own insulating properties, and not at all upon the insulation that might be afforded by a duct, are of the highest grade, bearing the well-known names of the Standard Underground Cable Company, Habirshaw, Norwich, Safety and Washburn & Moen. Tests for insulation resistance have shown an average of nearly 2,300 megohms per mile for arc conductors, and over 1,100 megohms per mile on alternating current conductors. On the 500-volt railway wires tests have run as high as 5,800 megohms per mile, with a minimum of over 1,700 megohms. The cables are all covered with lead or lead and tin, and provision is made against the electrolytic tendencies of the return currents from the street railway circuits.

The conductors themselves are of No. 6 B. & S. gauge (13.3 mm²) arc circuits, and for the alternating incandescent light, and the power circuits 00 (67.43 mm²) and 0000 (107.22 mm²) are used, though on some of the railway lines cable as large as 500,000 circ. mils (253.3 mm²) is used. Where alternating currents are used the two sides of the circuit are run in the same duct, to avoid inductive effects.

The *distribution* from the ducts is effected on what may be termed the "block" system, that is to say, no attempt is made to tap the system between the regular manholes by hand holes or special distribution ducts, but subsidiary ducts are taken directly from the manhole to the block, and all distribution to individual consumers or users carried out within the block by means of internal courts, alleyways, yards, and sometimes housetops. The telephone company uses wrought-iron pipe without concrete for its subsidiary

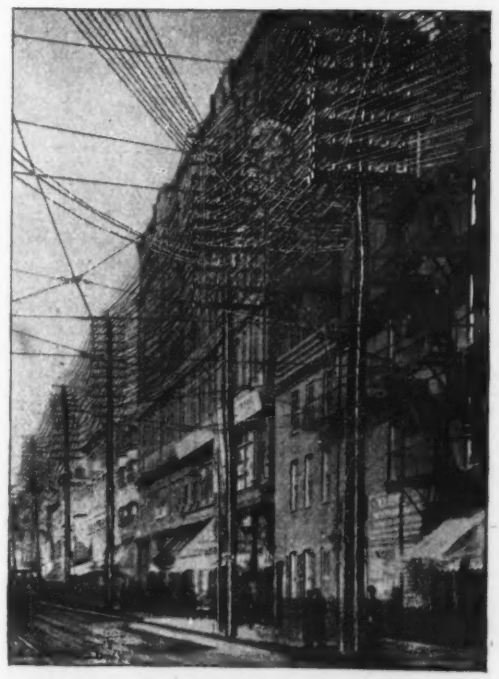


FIG. 3.—A FEW OVERHEAD WIRES.

ducts. The pipe leads from the nearest manhole to the side of a building, where it turns upward and is carried up the wall to a sufficient height to protect the cable from mechanical injury. The cable is then continued to a distribution box suitably located, from which point the individual service wires are run on the walls or roofs or within the building to the different subscribers within that block.

The cables employed by the New England Telephone Company contain usually 120, 60 or 30 pairs of wires, twisted to avoid induc-

tion and insulated by paper. The largest of these has an outside diameter of 2¼ inches (56 mm) over the lead sheath.

The process of drawing in the lead-covered cables from manhole to manhole is doubtless familiar enough to the dwellers in our large cities, but we may perhaps be pardoned if we explain this matter in the briefest way possible. Taking two consecutive manholes, say *A* and *B*, a man in *A* runs a jointed rod of wood through a duct to *B*. This jointed rod is in sections, and the first section being pushed into the duct the end of the second is screwed on to it, and both are pushed forward; a third section is then screwed on and the operation repeated until the first section reaches the man in *B*; a small rope is attached to the *A* end of the rod and pulled through to *B*, the man in *B* unscrewing the several sections of the rod as he pulls them through, until he reaches the small rope, which, in turn, is employed to pull through the duct a larger rope; this rope is carried up, and out of the manhole, to a windlass at the *B* end. The lead-covered cable on its reel is arranged on a support at *A* so as to unwind into the manhole and be drawn through by the men turning the cranks of the windlass at *B*, passing over sheaves or guides to prevent injury to the covering, and to direct its course.

In connecting an arc-light loop to the underground conductor the circuit is opened and the wires carried in a pipe to the foot of the pole, inside which it passes up to the lamp. Where the pole is at a distance from the conduit a small manhole is built at the foot of the pole for convenience in cable drawing. For commercial lighting in blocks the method of distribution is substantially similar to that in the case of telephones. In the case of the railway feed wires an iron pipe is carried from the manhole to the pole at which the service connection is to be made, and continued up to a switch box, from which an insulated wire makes connection with the trolley wire. A cable is then drawn into this pipe, completing the connection between the switch box and the manhole, and at the latter point is connected to the feeder. An underground connection is also made at each manhole from the return wire in the ducts to the nearest point of the track.

Figs. 4 and 5 show the general appearance of a subway trench with pipe in process of laying, and the next illustration indicates the character of some of the obstructions met with.

From a summary prepared by the commissioner it appears that there are already in the city of Boston over 2,000,000 feet of underground duct, of which 825,000 feet are for electric light and power service, 1,276,000 feet for telephone and telegraph circuits, and 19,000 feet for signaling and miscellaneous purposes.

Fig. 4.—Subway Trench Under Construction.

The number of feet of cable already in these ducts is 1,817,000.

The amount of this cable employed for telephonic and telegraphic purposes approximates 600,000 feet, containing about 90,000,000 feet of wire.

The power and lighting cables are 1,115,000 feet in length.

For miscellaneous electrical service 2,000,000 feet of underground wire are employed.

It will be seen from the foregoing that no "municipal ownership" attaches to the conduits. They are built and owned by the operating companies, under the supervision and direction of a municipal officer whose powers are absolute, subject to an appeal to a board consisting of the city engineer, the superintendent of streets and the chairman of the Board of Fire Commissioners.

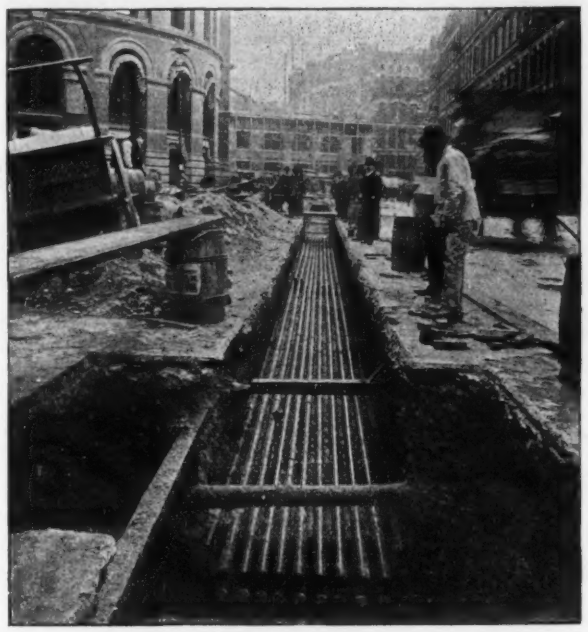


Fig. 5.—A Line of Conduits in Trench.

The expense will, of course, be very considerable, the Boston Electric Light Company, for example, being granted permission to issue bonds to the extent of $360,000 for this purpose. The price, however, which certain favored conduit construction companies were permitted to charge in Chicago and New York City, viz.: $1,000 per annum per duct per mile for a three-inch duct would, it will be seen, when capitalized amount to a very pretty sum.

In many cases a joint arrangement has been entered into by which several companies occupy the same trench, so as to avoid unnecessary disturbance of the streets and consequent interference with traffic. Much of the work in the more important and crowded streets is done on Sundays and at night so as to reduce the inconvenience to the public to a minimum. The inevitable cost has not been added to by any harsh or heroic measures, nor has the service been interfered with. The commissioner while carrying out the provisions of the law does so with tact, discretion and courtesy, and the representatives of the various companies have acted in no obstructive or unwilling manner.

Fig. 6.—A Typical Obstruction.

Neglected Evidence in the Berliner Case.

BY E. F. FROST.

In the many telephone suits that have been tried and adjudicated during the past eighteen years, none seems to have attracted so widespread and profound an interest as that of the suit of the government to annul the Berliner patent of 1891. In this, as indeed in all the other telephone cases, the most striking thing has been the evasion of every vulnerable point for successful attack on the part of the opponents of the American Bell Telephone Company, and the evasion on the part of said company of the onus of proof in their every assumption.

However, without going into the discussion of dead issues, whatever the merits of such in their proper places, let us carefully make a little research in the particular case of the Berliner 1891 patent on the microphone, claiming the constant-contact electrode. A careful study of the file in the case, as certified by the Patent Office, reveals an astonishing condition of things—the dense ignorance of the case on the part of the public and the seeming ignorance thereof on the part of the opponents of the Berliner patent as well—and a most astounding neglect, if not want of knowledge, of the evidence at hand which would prove the patent invalid; internal evidence in the case so glaringly patent that one who runs may read.

It is not necessary to attack the patent on the ground of fraud in the holding of the application in the Patent Office for 14 years; for there is every evidence that the case was conducted according to the *letter of the law*. Again, aside from this, there should be, if the patent was unwarrantably issued as it reads, evidence in the file of the patent application itself to show this; and such we shall find. A part of the evidence which I shall bring out was once, and once only, namely, in the year 1882, brought to bear against the Berliner application in an answer on the part of the examiner in charge at the time before the commissioner on an appeal from the examiner's ruling.

The history of the Berliner case up to and including the year 1892, and it need be considered no later, is as follows:

On April 14, 1877, Berliner filed a caveat for the microphone, in which (from what I read in the file, for I cannot have access to the caveat itself), he described the continuous contact between the diaphragm and electrode as essential to the transmission of sounds.

On June 4, 1877, he filed an application for a telephone, in which he described its operation as a make-and-break. In the meantime Berliner's views had evidently changed, for instead of describing or claiming the continuous contact between the diaphragm and electrodes, on the contrary, he takes particular pains to describe a break-and-make contact, and also to claim it for the transmission of sounds of musical pitch, and of special sounds, which special sounds he defines. Here is his language: "To this end my invention consists, Third: In the combination with said vibratory diaphragm of a pin arranged out of contact with the same, but within its field of vibration and in the same electrical circuit, for producing and transmitting special sound waves, as more fully hereinafter set forth.

"These simple instruments will reproduce any musical sound uttered in the neighborhood of one of them; but for the reproduction of special sound such as speech they are not adapted for the following reasons: In accepting the graphical name of a wave for a vibration we must consider the same to have two dimensions, namely, length and depth or height. In Fig. 7, I have represented three sections of waves, all of the same length and height, yet they differ in shape and their highest point is not always situated in the centre of their length. Such is the case with sound waves of various kinds of sounds. In a pure musical tone the shape of the wave is entirely regular like in section I, but in every other sound this is not the case. It is therefore evident that the apparatus described thus far can but transmit a pure musical sound because it transmits only a number of vibrations per second which is equal to the lengths of the waves, but nothing of the nature of each wave and the shape of their curves is recorded. This I accomplish however by situating within the vibrating field of the plate, *A*, a second screw *E*. In Fig. 6, the dotted line indicates the vibrating field of the plate, *B*, the screw in contact with the plate and *e* the second screw. It will now happen in special sounds (meaning the nature of every sound besides its certain musical pitch) that the plate will not always strike the screw *e* in the middle of the duration of one wave or vibration and taking for instance the duration of one wave to be one minute, the plate in special sounds will sometimes strike the screw *e*, some time after 20 or 25 seconds from its beginning. This now is exactly recorded by this secondary screw *e* which also makes an electric connection whenever the plate *A*, touches it and at the receiving apparatus these special sounds will therefore be noticed. I have thus succeeded in producing a great many special sounds such as the vowels and others. The principle of reproducing special sounds by break-and-make of contact rests mainly in the use of this secondary contact screw."

Claim 1 reads:

"An instrument for transmitting and reproducing sound waves by the agency of electricity consisting of a metallic diaphragm or other vibratory medium connected to or forming part of one pole of an electric circuit and arranged in contact with the opposite pole thereof, and capable of being put in vibration by the action of the electric current, substantially as set forth."

Claim 2 reads:

"An instrument for transmitting and reproducing sound waves by the agency of electricity, consisting of two vibratory plates of metal or other suitable material, one attached to or forming part of each pole of the battery arranged in contact with each other and capable of being put in vibration by the action of the electric current, substantially as set forth."

Claim 3 reads:

"The combination in one circuit of two or more vibrating diaphragms and contact pins, adapted to operate similarly for the production and transmission of sound waves when one diaphragm is caused to vibrate by means of any sound, substantially as set forth."

Claim 4 reads:

"In combination with the metallic diaphragm and its contact pin, of a secondary pin out of contact with said diaphragm but within its vibratory field, and the same electric circuit, the whole adapted to operate as set forth for transmitting special sounds."

This Claim 4 was erased as per amendment of August 8, 1877.

This case was amended six times before any action was taken on the part of the office. To avoid confusion the examiner requested the filing of a new specification, which was done October 23, 1877.

This new specification, while differing but little from the parts quoted, and that not essentially, shows the important fact that Mr. Berliner was now more fully convinced than before that the continuous contact between the diaphragm and electrode of his caveat was erroneous, and that the make-and-break was correct; for he now not only specifies it but also distinctly claims it.

He says:

"My invention consists:

"First. In an instrument for transmitting and reproducing sound waves by voltaic agency, consisting of one or more diaphragms forming the poles of a galvanic circuit in contact with each other and adapted to vibrate freely when the contact is either modified or broken according to the strength of the vibrations, substantially as hereinafter specified."

Claim 1 reads:

"An instrument consisting of the two poles of an electric circuit in contact one with the other, either or both of said poles forming a vibratory diaphragm or medium to be used for transmitting and reproducing sound vibrations by either altering or disconnecting said contact at each vibration."

Claim 2 reads:

"A system of two or more instruments within the same electric circuit each consisting of two poles of said circuit in contact one with the other, either or both poles being vibratory so that any vibration which is made at one contact is reproduced at the other."

On Sept. 1, 1880, the application was amended by striking out the whole specification and claims, with the exception of the caption and signatures and substituting this third specification and claims. Now for the first time appears the description of electrodes in constant contact. Now for the first time the constant contact of electrodes is claimed. Had Berliner in the meantime changed his mind again? Moreover, all description, all claims to the instrument as a receiver are now for the first time disclaimed and set out as matter for a separate application. This separate application was filed Sept. 3, 1880, and was issued Nov. 2, 1880, as No. 233,969.

This separation was achieved in order to limit the application of June 4, 1877, to the microphone transmitter. In the course of the consideration on the part of the examiner of this amended application of Sept. 1, 1880, the claim for electrodes in constant contact was rejected as entirely new matter, and contradictory of the claims as originally filed. To this ground the applicant took exception, on the ground that the application was a continuation of the caveat. In the letter of the attorney to the commissioner, dated November,

1881, he said that the application was a continuation of the caveat, and that the Office took this view because interfering applications were filed during its life, and the caveator received no notice to complete. It was argued by the attorney that the commissioner decided in the case of H. L. Roosevelt, Telephone Signals, that a second application could be amended by a former one, and such amendment was accordingly made, the drawings of the two cases exchanged and the specifications transferred by amendment. He, therefore, deduces that the decision furnished precedent for the amendment of an application by a caveat for the same invention, since the relation between them is strictly analogous to that between divisional applications.

Again, in his letter of Feb. 24, 1882, to the commissioner, he stated that he "infers" the Office to admit the amendments to be justified by the caveat--and if the caveat could be, under the rule, coupled with the application, the amendments would be legitimate.

On Feb. 28, 1882, the examiner, Mr. F. L. Freeman, says in a letter to the attorney: "So far as amendments recently filed and objected to by the examiner refer to an instrument comprising a metallic diaphragm and a spherical contact point, which habitually maintains but varies contact with the diaphragm, such amendment could be justified by the caveat if an amendment of an application by a caveat was admissible."

On the March 1 following, an appeal to the commissioner in person was taken in the matter. This was an interlocutory appeal. In this letter of appeal occurs the following: "4. It" (that is, the action of the examiner) "is contrary to truth and justice, it being admitted at the office that applicant was the first to disclose the invention described in said amendment to the office and to the world."

The appeal was heard on March 6, 1882. The decision of the commissioner was handed down on the 28th of the same month, being written on the back of the examiner's answer, as follows: "Paper No. 47, March 6, 1882. Answer to appeal to commissioner. After careful consideration of this case I am satisfied that the amendments presented by the applicant herein referred to, and rejected by the examiner should be admitted so far as it describes and claims a telephone with a continuous contact between the diaphragm and electrodes—to that extent the decision of the examiner is overruled.

"(Signed) E. M. Marble,
"March 28, 1882. Commissioner."

The decision is not recorded in the published or manuscript decisions of the commissioner.

What of all this?

First—It is perfectly clear that the decision of the commissioner did not warrant the claim for electrodes in constant contact, but, on the contrary, his language expressly says that the description and claims shall be for continuous contact between the diaphragm and electrodes—a vast difference.

Second—It is perfectly clear that the amendment was wholly unwarranted, and that there was not only no reason or law for the commissioner's decision, but, on the contrary, that there was law and fact to apply the law against such decision as rendered, prohibiting the amendment of the application by the caveat.

That the application was not a continuation of the caveat is beyond question; for the matter of the caveat is directly opposed to that of the application, and, therefore, the caveat died on April 15, 1878, since it was not renewed.

The Supreme Court of the United States, by Mr. Justice Bradley, says in Railway Co. vs. Sayles, (1878), 97 U. S., 554, (563). "The law does not permit such enlargements of an original specification, which would interfere with other inventors who have entered the field in the meantime, any more than it does in the case of re-issues of patents previously granted. Courts should regard with jealousy and disfavor any attempts to enlarge the scope of an application once filed, or of a patent once granted, the effect of which would be to enable the patentee to appropriate other inventions made prior to such alteration, or to appropriate that which has in the meantime gone into public use."

The law at the time the so-called amendment to the Berliner application was admitted being as above quoted, one who is at all familiarly acquainted with the history of telephonic invention will see at once that this law was not only subverted and ignored in spirit, but in letter also—in that it enlarged the scope of the original application; in that it appropriated the inventions of other inventors made prior to Sept. 1, 1880, and which had gone into public use in the meantime.

Again, the Berliner substitute specification of 1880 not only introduced new matter, that amendment by caveat on a different invention, but it also excluded by disclaimer material which had been prominent in the first two specifications. This excluded matter constituted that of a distinct and separate application for letters-patent, subsequently issued as No. 233,969 of November 2, 1880, filed September 3, 1880, two days after the amendment of the 1877 case by caveat. This excluded matter was all that related to the identical instrument described as used for a receiver, the matter relating to the identical instrument described as used for a transmitter being retained in the 1877 application.

The 1880 patent distinctly says it to be a division of the application of June 4, 1877. This being so, and, moreover, the proof to the contrary being at hand in the first two specifications, how could the argument be made and maintained that the identical instrument used as a transmitter was invented at one time and constituted one invention, and that the identical instrument used as a receiver was invented at a subsequent time and constituted another invention? Surely the evidence shows that they constituted one and the same invention, and were discovered at the same time.

To sum up:

On April 14, 1877, Berliner filed a caveat for a telephone telegraph system, in which he described a mechanism in which there was continuous contact between the diaphragm and electrode.

On June 4, 1877, he filed an application for a new invention, in which he described a make and break contact between the diaphragm and electrode, and did not claim constant contact, but in which he did claim more with reference to the mechanism as a receiver.

On October 23, 1877, a substitute specification was filed, in which the make-and-break was not only described but also claimed, and in which the mechanism was treated chiefly as a receiver.

On April 15, 1878, the Berliner caveat expired by limitation.

On Sept. 1, 1880, Berliner filed his second substitute application in which, for the first time, the description and claim for electrodes in constant contact appeared, and in which the matter relating to the identical mechanism as a receiver was set out for a distinct application, and so disclaimed.

On Sept. 3, 1880, Berliner filed the application which became patent No. 233,969, of Nov. 2, 1880, relating to the mechanism as a receiver, and which stated itself to be a division of the application of June 4, 1877.

The 1877 application as amended by the substitute application of 1880 was rejected on the ground that the amendment introduced new matter.

Berliner claimed the right to amend by caveat.

The examiner decided that Berliner had no such right.

The case was appealed to the commissioner in person. (Interlocutory Appeal.)

The decision of the examiner was overruled by the commissioner's decision handed down March 28, 1882.

There was no record of this decision in either the published or manuscript commissioner's decisions.

The decision limited the amendment to continuous contact between the diaphragm and electrode.

The language of the decision was stretched to mean constant contact between electrodes, and was so issued in 1891.

Conclusion:

That the Berliner patent of 1891 was unwarrantably issued, in that the application was filed on June 4, 1877, was in 1880 changed, radically changed, changed by the substitution of new matter diametrically opposed to that in the first presentation, this being not only inadmissible of itself even if the matter introduced were taken from a live caveat, but especially inadmissible when taken from a dead caveat, in this case a caveat that had been dead long prior to the substitution; such introduction being obnoxious and illegal generally.

The Electric Railway in Rome.

It is reported that an electric car will commence running in Rome in the month of September next between Porta Salaria and the Pincian route. The government has given strict orders regarding the maximum rate of speed, which is not to exceed 8.6 miles an hour in the beginning. Should no accident occur, however, it is said that this will not be insisted upon after a fair trial has been given the system.

History of the Northwestern Electrical Association.

N August 19, 1892, the Northwestern Electrical Association was founded at Marienette, Wis, its announced object being to furnish the necessary opportunities for the exchange of ideas concerning matters of mutual interest in the electrical business. The first meeting was well attended by electricians, officers and managers of the electrical plants of Northern Michigan and Wisconsin, and the enthusiasm then manifested in the prospective success of the organization has been well justified by the future.

The first president was Mr. H. C. Higgins, of the Marienette Gas, Electric Light & Street Railway Company. The other officers were as follows: Secretary, T. A. Pamperin; treasurer, Lewis Lusk; directors, C. S. Leykom, Jas. R. Dee, F. B. Warren, A. A. Foreman and John F. Fitzpatrick.

A number of honorary members were elected at this meeting, including H. C. Hamilton, of Sault Ste. Marie, Canada; W. T. Sullivan, electrician of the Chicago Auditorium, and J. E. Bowers, president of the Crystal Falls Board. After the adjournment of the meeting, the visitors, under the guidance of President Higgins, inspected the electric plants of Marienette, the out door feature of the association meetings being thus early inaugurated.

The second meeting of the association was held at Oconto, Wis., Oct. 12, 1892. While the details relating to this meeting are meagre, there is every reason to believe that it formed no exception in the interrupted course of progress. The social feature was here first formally introduced, Secretary Pamperin having given a banquet to the members present. President Higgins and Secretary Pamperin were re-elected.

At the third meeting, held at Milwaukee, final arrangements were made for the incorporation of the association, and on Feb. 16 the necessary documents were filed. The articles of incorporation state that the corporation is organized for the advancement of the electrical industries, and for the promotion of the social and moral intercourse of the members. Members are divided into three classes,—active, associate and honorary. The first class is limited to owners, managers and superintendents of plants, electricians, electrical or mechanical engineers, all engaged in the business of producing and supplying electricity for commercial or public use. Associate members comprise manufacturers, corporations or individuals, who are interested, directly or indirectly, in advancing the use of electricity. Honorary members may be elected upon the unanimous vote of the corporation. The by-laws require that two meetings shall be held yearly, an annual meeting at Milwaukee in January, and a semi-annual meeting in July, at any place designated at the preceding annual meeting.

Anticipating somewhat the final action on the articles of incorporation, the third meeting was called the first annual meeting, and extended over two days—Wednesday and Thursday, Feb. 14-15, 1894.

The principal matter discussed was a proposition to ask the legislature to pass a bill providing for the appointment of electrical commissioners in cities lighted by electricity, but no final action was taken on the subject. Mr. Carroll Collins was elected president for the ensuing term, Mr. C. C. Paige, vice-president, and Secretary Pamperin had the responsibility of treasurer added to his other duties.

The fourth meeting and first semi-annual convention was held in the State Capitol at Madison, Wis., on July 19 and 20, 1893, and was the first at which a number of papers was read, and is also notable from having inaugurated the policy of encouraging the attendance of representatives of electrical supply and manufacturing companies, and making provision for the display of exhibits of central station apparatus, material and appliances. There were no less than six papers on the first formal programme, as follows: "Corliss Compound Engines," by E. L. Debell; "Gas Engines Applied to Electric Light Work," by George A. Farwell; "Alternating-Current Phenomena," by George Cutler; "Economy in the Use of Meters," by Prof. D. C. Jackson; "Average Rates of Northwestern Central Stations," by P. H. Korst; "The Business End of Electricity," by H. C. Thom. In addition, there were discussions on several topics of importance in central station management. This meeting may be considered as marking a new era in the history of the association, and was the real beginning of its marked professional character, which has since made it so widely known.

On Jan. 17, 1894, the fifth meeting and second annual convention of the association under the new regime, was held at the Pfister Hotel, Milwaukee, and its success may be judged from the attendance of members and visitors, which numbered over a hundred. Its growing importance was also manifested in the fact that the Mayor of Milwaukee delivered an address of welcome and tendered the freedom of the city to those in attendance, while the lively discussion of the papers read disclosed a spirit which augured well for the future usefulness of the body. The programme of papers was as follows: "Advantages of Direct-Connected Generators," by W. N. Stewart; "Essential Station Instruments," by Prof. D. C. Jackson; "New Things in Electricity," by W. W. Low; "Economical Use of Transformers," two papers, one by W. Forman Collins, and the other, by P. J. McFadden; "Corliss Compound Engines," by E. L. Debell; "Trend of Electrical Investment," by H. C. Thom. A banquet, at which 75 plates were laid, occupied the evening of the second day, and the third day was devoted to visits of inspection to electrical plants.

The following officers were elected at this meeting: President, C. C. Paige; first vice-president, W. B. Baker; second vice-president, E. L. Debell; secretary, H. C. Thom; treasurer, G. F. Merrill; directors: W. Goltz, Pliny Norcross and John Shuette.

St. Paul was the place of the sixth meeting of the association and of its second semi-annual convention, and notwithstanding the great business depression then prevailing and the complications to be expected in traveling on account of the great railway strike in progress, the gathering was a most unqualified success. The sessions extended over three days, July 18, 19, and 20, and were models of dispatch and thoroughness. With no lack of good papers and competent critics, the proceedings throughout excited the liveliest interest. Two of the papers were by eastern men who traveled to Milwaukee especially to participate in the proceedings at a time when railway traveling was not lightly engaged in, and several of the papers read attracted national attention.

The following was the programme of papers: "Economy in the Boiler Room," by J. C. McMynn; "The Relations between Technical Schools and the Electrical Industries," by Prof G. D. Shepardson; "The Cost of Producing Electrical Energy," by B. J. Arnold; "The Modern Dynamo," by C. H. Chalmers; "Economical Operation of Electric Light Plants," by C. K. Stearns; "Incandescent Lamps," by A. D. Page; "A Question of Public Policy," by A. R. Foote.

The last day of the convention was pleasantly passed in visits to the various electrical industries of St. Paul, and in pleasure excursions. At this and the previous meeting at Milwaukee large commercial displays were made, this feature having now become thoroughly established. The office of secretary was at this convention made a salaried one.

In accordance with the provisions of the by-laws, Milwaukee, on Jan. 16, 17 and 18 of the present year, was the seat of the third annual convention, which was the seventh meeting of the association.

Notwithstanding the great success of the St. Paul convention, still another step forward was made by the association at this meeting, several of the papers, and particularly the Welsbach discussion, being of the first importance. As previously, the interest in the proceedings were unflagging, while the commercial feature was still further developed. The presidential address of President Paige was a strong argument against municipal interference with electric lighting interests, while the paper of Mr. Condict on "A Storage Battery and Electric Railway and Lighting Plant" was an engineering contribution which attracted widespread interest. Other papers read were the following: "Hints Upon Daily Work about a Dynamo Plant," by Pliny Norcross; "Interior Conduit and Interior Wiring," by C. E. Burton; "Incandescent Lamps vs. Welsbach Burners," by William Goltz; "Accumulators for Central Lighting and Power Stations," by J. R. Markle; "Incandescent Lighting on the Meter and 'Flat' Systems," by G. L. Cole; "Auxiliary Adjuncts in Electricity," by T. R. Mercein; "Competition," by J. Schuette; "Water Power," by G. A. Davis.

A notable incident of the sessions was the discussion of a proposition to widen the scope of the association so as to include the entire Western States. The general sentiment of the members was opposed to such a departure from the original design of the association, and for the reason that it would tend to a lack of

homogeneity of interests, and therefore largely curtail the benefit to be derived by individual members.

The following officers were elected at this meeting :

President, H. C. Thom; first vice-president, George Grimm; second vice-president, Pliny Norcross; secretary, William Gotz; treasurer, George Schuette; directors, F. Copeland, O. M. Rau and E. M. Highlands.

Experiments with Electric Waves.

BY ALFRED G. DELL.

In performing the following experiment with a view to ascertaining the effect of the force from an inductorium upon the inside of the metal cylinder, a length of No. 16 copper wire was wound upon the wooden framework, so as to form a practically continuous helix, two feet in diameter and two feet long, the convolutions being wound in saw-cuts to prevent mutual contact. One terminal of a Ruhmkorff induction coil was attached to one end of the helix, and the other end of the coil grounded. The following results were obtained: The circle described in THE ELECTRICAL WORLD of May 18, when held in the neighborhood of the helix, gave brilliant sparking at its air-gap; a new incandescent lamp bulb lighted up when placed with its apex toward the helix, as did a Geissler vacuum tube when held in the neighborhood of the helix. It was impossible to obtain any light from a lamp bulb in which the filament had been burned out, and the bulb somewhat blackened. It was also impossible to obtain any light from a new lamp bulb when placed on the inside of the helix. A Geissler tube was then suspended by wire attached to one of its electrodes, so that it hung in the centre of the helix but remained entirely dark, except for the occasional appearance of star-like light at the electrode to which the suspension wire was attached. The same result was obtained when the tube was moved nearer the side of the helix. The other end of the suspension wire was then attached to a small brass plate, and the star-like effect at the tube was increased. Upon approaching the plate with the experimenter's hand, the tube emitted flashes, and on continuing the approach, began to light up; when the hand was several inches from the plate the tube lighted up entirely.

The wire helix was then cut near the centre, and the spark-gap arrangement inserted. The outer ends of the helix were then connected to the induction coil, and a resonating circle tried, but only feeble sparking resulted, and no light whatever in the lamp bulb or the vacuum tube was obtained with the spark-gap arrangement in circuit with the helix.

Some beautiful experiments can be made with the arrangement first described above. For instance, when a Geissler tube is connected to the end of a long wire, the tube placed outside the field of force, and the other end of the wire led to a point near the wire cylinder, if a person standing near the cylinder places a finger on the end of the wire leading to the tube the latter will light up, the light in the tube varying with the distance of the person from the wire cylinder. The person will also receive slight shocks while holding the end of the wire.

Dr. P. J. Gibbons' Discoveries in Electricity.

Dr. P. J. Gibbons, of Syracuse, who believes that electrocution does not electrocute, has recently announced that he has proven to his own satisfaction that electricity is "cold instead of warm." He is firmly convinced that the prevailing belief that electricity is composed of heat and light is wrong, and further that electricity is really cold, and is capable, therefore, of producing cold. Dr. Gibbons says he was led to this belief as a result of several reasons. In the first place, he had always thought it strange if electricity was composed of heat and light that it was more apparent on a cold day than on a warm one. He was aware, he says, that on a cold day one could light gas by rubbing one's feet along a carpet and then bringing a finger in conjunction with the gas jet, while on a warm day this could not be done. He believes that in the near future electricity will be gotten into a liquid state, and in that state will be used to produce cold, but whether this takes place or not, it can be used for the same purpose in its present state. This theory, he claims, "has never been advanced before, much less demonstrated, as I have done." And this is the writer whom the newspapers accept as an authority on electro-medical questions!

Electrodynamic Machinery.—XLI.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

282. The torque produced by a loop, situated in a uniform magnetic flux, varies with the angular position of the loop. For example, returning to Fig. 192, the torque of the active loop is zero in the position d, and is a maximum in the position a. The electrodynamic force exerted by the side a', a'' will be $\mathfrak{B}\, l \frac{i}{10}$ dynes, and if the radius at which this acts about the axis—*i. e.*, half the length of the side a', a^{iv} be a cms, then the torque exerted by this side will be $\frac{\mathfrak{B}\, l\, i\, a}{10}$ dyne-cms. Similarly, the torque exerted in the same direction around the axis by the side a'', a^{iv} will be also $\frac{\mathfrak{B}\, l\, i\, a}{10}$ dyne-cms, so that the total torque around the axis will be $2\,\frac{\mathfrak{B}\, l\, i\, a}{10}$ dyne-cms.

If the loop moves under the influence of this torque through a very small angle $d\,\theta$, the work done will be $\tau\, d\,\theta = \frac{2\,\mathfrak{B}\, l\, i\, a}{10} d\,\theta$, but $a\, d\,\theta = d\,s$, the small arc moved through, as shown in Fig. 195, so that the work done will be $\frac{2\,\mathfrak{B}\, l\, i\, d\,s}{10}$. The amount of flux linked with the loop during this small movement will be $2\, d\, s\, l = d\phi$, so that the work done becomes $\frac{i}{10} d\,\phi$. Consequently, in any small excursion of the loop, the work done will always be the product of the current strength and the increase of flux therewith enclosed. It is evident that the amount of flux which is brought within the loop by a given small excursion varies with the position of the loop; that is to say, a small excursion through the arc $d\,s$, at the position represented both in plane and isometric projection, where the plane of the loop coincides with the direction of the flux, in Fig. 195, will introduce an amount of flux $= 1\,\mathfrak{B}\, d\, s$. But the same small excursion in the position represented in Fig. 196—*i.e.*, where

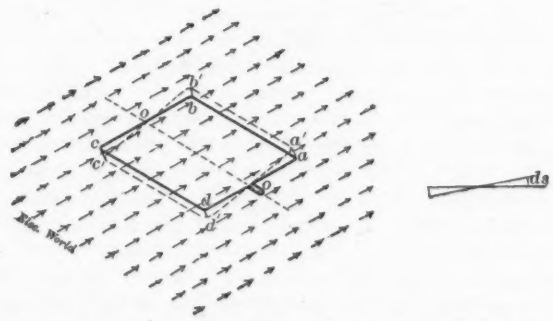


FIG. 195.—DIAGRAM SHOWING SMALL ANGULAR DISPLACEMENT ABOUT ITS AXIS, OF A LOOP IN UNIFORM MAGNETIC FLUX IN ITS PLANE.

the plane of the loop is perpendicular to the flux—will introduce practically no additional flux into the loop. At any intermediate position it will be evident that the flux introduced by a small excursion of arc $d\,s$ will be $l\, d\, s\, \mathfrak{B} \cos\theta$, where θ is the angle included between the plane of the loop and the direction of magnetic flux. The torque exerted by the loop, therefore, varies as the cosine of the angle between the plane of the loop and the direction of the external flux.

283. Let us now consider the application of the foregoing principles to the simplest form of electromagnetic motor. For this purpose we will consider a smooth core armature A, Fig. 197, situated in a bipolar field. We will suppose that the total magnetic flux passing through the loop of wire in the position shown from the north pole N, to the south pole S, is Φ webers, and that a steady current of i amperes is maintained through the loop of wire attached to the armature core. In the position of the loop as shown in Fig. 197, there will be no rotary electrodynamic force exerted upon the wire, and the armature will be at a dead point. If, however, the armature be moved from this position into that shown in Fig. 198, so that it enters the magnetic flux, assumed to be uniformly distributed over the surface of the poles and armature core, then a rotary electrodynamic force is set up on the wire, and communi-

cated from the wire to the armature core on which it is secured. The torque being $\frac{i}{10} \cdot \frac{d\phi}{d\theta}$ dyne cms, where i is the current strength in amperes and $\frac{d\phi}{d\theta}$ the rate at which flux enclosed by the loop is altered per unit angle of displacement. If, for example, the total

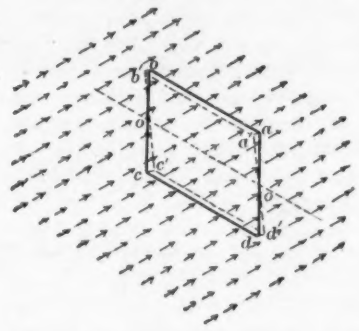


FIG. 196.—SMALL ANGULAR DISPLACEMENT OF A LOOP IN UNIFORM MAGNETIC FLUX PERPENDICULAR TO ITS PLANE.

flux $\Phi = 1$ megaweber, and the polar angle over which we assume that this flux is uniformly distributed is 120°, or $= \frac{2\pi}{3}$ radians, then the rate of emptying flux from the loop during its passage through the polar arc will be $\frac{1{,}000{,}000}{\frac{2\pi}{3}} = \frac{1{,}500{,}000}{\pi}$ webers per radian, and if the strength of current in the loop be maintained at 20 amperes, the torque exerted by the electrodynamic forces around the armature shaft will be $\frac{20}{10} \times \frac{1{,}500{,}000}{\pi} = 955{,}000$ dyne-cms. Since a torque of 1 lb-foot = 13,550,000 dyne-cms, this torque would be represented by $\frac{955{,}000}{13{,}550{,}000} = 0.0705$ pounds-feet, or 0.0705 pound at one foot radius.

The armature will continue to move under this torque, if free to do so, until the position of Fig. 199 is reached, where it is evident

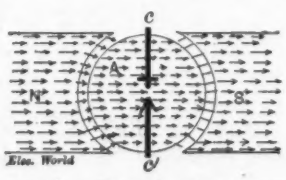


FIG. 197.—DRUM ARMATURE WITH SINGLE TURN OF ACTIVE CONDUCTORS AT DEAD POINT.

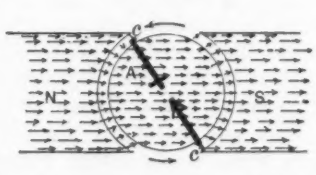


FIG. 198.—ACTIVE CONDUCTOR ENTERING POLAR FLUX.

that a still further displacement will not increase the amount of flux threaded through the loop.

The amount of work which will have been performed by the electrodynamic forces during this angular displacement of 120° or $\frac{2\pi}{3}$ radians, will have been $\tau\theta = 955{,}000 \times \frac{2\pi}{3} = 2{,}000{,}000$ ergs, or, simply $\frac{i}{10}\Phi = \frac{20}{10} \times 1{,}000{,}000 = 2{,}000{,}000$ ergs $= 0.2$ joule.

284. The armature may continue by its momentum to move past the position of Fig. 199, to that of Fig. 200. As soon as it reaches the latter position, a counter electrodynamic force will be exerted upon it tending to arrest and reverse its motion. Consequently, if the electrodynamic force is to produce a continuous rotation, it is necessary that the direction of the current through the coil be reversed at this point; *i. e.*, commuted, or the direction of the field be reversed as soon as this point is reached. As it is not usually practicable to reverse the field, the direction of current through the coil is reversed by means of a commutator, so that when the position of Fig. 200 is reached, the current is passing through the wire in the opposite direction to that as shown by the arrow. Under these circumstances, the electrodynamic force and torque continues in the same direction around the axis of the armature and expends another 0.2 joule upon the armature in its rotation to the original position shown of Fig. 197.

It is to be remembered that the representation of the flux in Figs. 197-200 is diagrammatic, since the flux never terminates abruptly at the polar edges, and is, moreover, affected by the flux produced around the active conductor.

285. The total amount of work done in one complete revolution of the armature upon a single turn of active conductor is, therefore, $\frac{2i\Phi}{10}$ ergs, at $\frac{2i\Phi}{100{,}000{,}000}$ joules.

If the load on the motor be small, so that the momentum of the armature can be depended upon to carry it past the dead-points which occur twice in each complete revolution, the armature will make, say n revolutions per second, and the amount of work absorbed by the armature loop in this time will be $\frac{2i\Phi n}{100{,}000{,}000}$ joules in the second, or an activity of $\frac{2i\Phi n}{100{,}000{,}000} =$ watts.

The E. M. F. generated by the rotation of this loop through the magnetic field, considered as a dynamo, will be $\frac{\Phi n w}{100{,}000{,}000}$ volts, (Section 120) where w, in this case is 2, since there are two conductors upon the surface of the armature counted once completely around. The C. E. M. F. will, therefore, be $\frac{2\Phi n}{100{,}000{,}000}$ volts, and the activity of the electric current upon this C. E. M. F. will

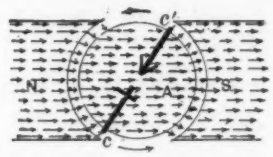


FIG. 199.—ACTIVE CONDUCTOR LEAVING POLAR FLUX.

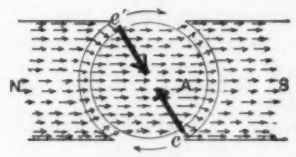


FIG. 200.—ACTIVE CONDUCTOR RE-ENTERING POLAR FLUX, AND ACTED ON BY OPPOSING ELECTRODYNAMIC FORCE.

be $\frac{2i\phi n}{100{,}000{,}000}$ watts as above. Hence it appears that in this, as in every case, the torque and work produced by an electromagnetic motor depends upon the C. E. M. F. it can exert as a dynamo.

286. Fig. 201 represents a gramme-ring armature, carrying a single turn of conductor, situated in a bipolar field. If the total useful flux through the armature is Φ webers, as before, half of this amount will pass through the turn, or $\frac{\Phi}{2}$ webers, since the flux divides itself into two equal portions, as represented in the figure. It will be evident, as before, that starting at the position of Fig. 201, there will be no rotary electrodynamic force exerted upon the loop, until it enters the flux, assumed to commence beneath the edge of the pole-piece, and the torque will then be uniform at the value $\frac{i}{10} \cdot \frac{d\phi}{d\theta}$ dyne-centimetres, until the turn emerges from beneath the pole-piece at L. The work done in this passage will have been $\frac{i}{10} \cdot \frac{\Phi}{2}$ ergs, and this work will have been taken from the cir-

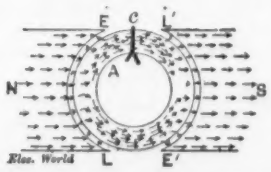


FIG. 201.—GRAMME RING ARMATURE WITH SINGLE TURN OF ACTIVE CONDUCTOR AT DEAD POINT.

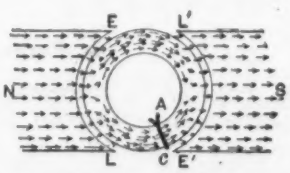


FIG. 202.—GRAMME RING ARMATURE WITH SINGLE TURN OF ACTIVE CONDUCTOR.

cuit, and, therefore, from the source of E. M. F. driving the current i, and will be liberated as mechanical work (including frictions). If, by the aid of the commutator, the direction of the current around the loop be reversed, the turn when caused either by momentum or by direct displacement to enter the field at E, Fig. 202, will again receive a rotary electrodynamic force whose torque is $\frac{i}{10} \cdot \frac{d\phi}{d\theta}$, until the angle θ has been again passed, when the work

performed will be $\frac{i}{10} \cdot \frac{\Phi}{2}$ ergs as before. The total work done upon the armature in one revolution will, therefore, be $2 \times \frac{i}{10} \times \frac{\Phi}{2} = \frac{i\,\phi}{10}$ ergs, and if the armature make n revolutions per second, the activity expended upon it will be $\frac{i\,\phi\,n}{10}$ ergs per second $= \frac{i\,\phi\,n}{100{,}000{,}000}$ watts; but considering the rotating armature in that case, as a dynamo armature, its E. M. F. will average $\frac{\phi\,n}{100{,}000{,}000}$ volts, since there is only one turn of the wire upon its surface, and, consequently, the activity expended on the armature will be $e\,i = \frac{i\,\phi\,n}{100{,}000{,}000}$ watts.

287. We have hitherto considered that the armature whether of the Gramme-ring or drum type, possessed only a single turn. As a consequence the torque exerted by a constant current in the armature will vary between a certain maximum and zero, that is to say, the motor will possess dead-points. If, however, a number of turns be uniformly wound upon the armature, as in the dynamos already considered, it will be evident that the same number of terms will always be situated in the magnetic flux beneath the poles, and in the air space beyond them in all positions of the armature, and that consequently, the torque exerted upon the armature will be constant when the magnetic flux and the current strength are constant. The torque exerted by the armature with w wires upon its surface, counted once completely around, will be $\frac{i}{10} \cdot \frac{\phi\,w}{2\,\pi}$ dyne-cms, whether for a Gramme-ring or a drum armature, and this whether the armature be smooth-cored or tooth-cored.

That this is the case will be evident from the following consideration. The work done on a single wire in one complete revolution is $\frac{i\ \phi}{10}$ ergs, and if there are w wires on the surface of the armature, the total work done by electrodynamic forces in one revolution will be $\frac{i\,\phi\,w}{10}$ ergs. But the work done by a torque τ dyne-cms exerted through an angle of θ radians is $\tau\,\theta$ cm-dynes or ergs, and since one revolution is $2\,\pi$ radians, the work done by the torque will be $2\,\pi\,\tau$ ergs. Therefore, $2\,\pi\,\tau = \frac{i\,\phi\,w}{10}$, or $\tau = \frac{i}{10} \cdot \frac{\phi\,\omega}{2\,\pi}$ dyne-cms.

For example, if a Gramme-ring armature has 200 turns of wire, counted once all round the surface, and the current strength supplied to the armature from the external circuit to the brushes is 50 amperes, while the total useful flux passing from one pole through the armature across to the other pole is 5,000,000 webers, or 5 megawebers, then the torque exerted by the armature under these conditions will be,

$$\frac{50}{10} \times \frac{5{,}000{,}000 \times 200}{2\,\pi} = 795{,}800{,}000 \text{ dyne-cms} = \frac{795{,}800{,}000}{13{,}550{,}000} \text{ lbs-feet}$$
$$= 58.73 \text{ lbs-feet.}$$

(To be continued.)

Laboratory of Houston and Kennelly, Philadelphia.

The Berliner Patents.

To the Editor of The Electrical World:

Sir—I notice in your issue of July 13, 1895, an "opinion" of George Frederick Shaver of the Public Telephone Company, regarding the recent decision of the Court of Appeals in the Berliner case, the absurdity of which will be recognized by most of your readers, but as it may mislead some of those interested in the subject, I take the opportunity of making a few corrections.

He states that "It is obvious that the Berliner is limited by all that was patented and expired throughout the civilized world from 1877 to 1891, together with that which remained unpatented and public property." This, of course, is absurd. A fundamental principle of our patent system is that a patent is given to the first inventor. An application for patent is *prima facie* evidence of completion of the invention as early as the date of filing. Berliner's application was filed in 1877, and yet according to Mr. Shaver a publication or public use of the same invention occurring anywhere on earth at any time later than the date of filing and happening to be prior to the *issue* of the patent, nullifies the patent. According to that practice an inventor would have to file his application one minute and have the patent issued the next, if he would be sure of securing a valid patent.

I also quote the following from this gentleman's "opinion": "The Berliner device as patented is almost wholly inoperative, and when we abstract from its claims the principle and device shown in the Lake patent, which expired in England in 1894, also all German, French and other patents which have expired by failure of the payment of fees and by running their full course, we find that not only the Berliner but many superior transmitting devices have become public property, and that nothing remained in the Berliner patent of 1891 at the date of its issue that was new to the art or that any manufacturer would care to use. It may therefore be seen why the Bell Telephone Company inspired the great Fish to such unwonted activity in the Bate Refrigerator case, as if the doctrine of allowing the date of application to govern had obtained, the Bell Company's great scheme of keeping the 1877 application along until 1891 would have been a success, from their standpoint, and the state of the art would have been considered only prior to the date of application in 1877."

This is all nonsense. The Bate Refrigerator case had no effect whatever on the Berliner patent. The reason the Bell people were interested in that case was because the fate of their Edison carbon patents hinged upon it. The Bate case was decided against their interests, and the Edison patents became void, leaving the Bell Company with no fundamental protection on the transmitter except that afforded by the Berliner patent. The many German, French and other foreign patents referred to covered inventions that were all originated after the Berliner application was filed, and their expiration cannot affect its validity. Furthermore, these patents were for special structures, and not for the fundamental principle covered by the Berliner patent. It is possible that in any suit for infringement the Bell Telephone Company may bring, the Berliner patent will be declared void, but the reason for it will not be any of those stated by Mr. Shaver.

Wm. A. Rosenbaum.

New York, N. Y.

Resuscitation After Electric Shocks.

To the Editor of The Electrical World:

Sir—I am surprised at the editorial comments in your issue of the 6th inst., on the paper read by Dr. Bleile at the Niagara Falls meeting of the American Institute of Electrical Engineers. The writer of those comments could not have made them if he had heard Dr. Bleile read the paper, for he distinctly and emphatically enlarged upon the brief statements given in the printed advance copy, concerning resuscitation, advising that in every case of shock, a vigorous and prolonged attempt be made to bring the sufferer back to life. Your remarks bear every indication that they were written by some one who was not at Niagara, and who had only the advance copy of the paper to guide him. The sentiments you print were certainly not expressed in the discussion of the paper, nor by any one in after conversation, so far as I know. The remarks you make are unjust to Dr. Bleile and unworthy of The Electrical World.

Benj. F. Thomas.

Columbus, O.

(The editorial remarks to which Prof. Thomas takes exception were based upon Dr. Bleile's paper as printed. The writer of the comment, who was present when all but the first paragraphs of the paper were read at the Niagara meeting, unfortunately missed the supplementary remarks referred to, which will be printed in full in our columns when the revised copy of the paper is issued by the Institute. In the meantime, we offer our apologies to Dr. Bleile, with the assurance, which is probably unnecessary, that our comment was made in no "unworthy" spirit, but prompted by the extreme gravity of the subject to which it referred.—Ed.)

The Fresno (Cal.) Transmission Plant.

Work is fast progressing on the Electric Power Transmission Company's canal which is to carry water from the north fork of the San Joaquin River 33 miles to Fresno, Cal. It is to be in operation within 120 days and is to deliver from 1,000 to 1,200 hp there. It will supply 1,000 incandescent lights, 160 arc lights, motors for flour mills, planing mills and for various other purposes, with a reserve for street railways.

One third of the total power delivered will suffice for all the industries at present in operation or contemplated for the immediate future.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

Note.—Beginning with the issue of July 6, the following changes in the plan of this department were introduced: greater space than formerly will be devoted to abstracts of the more important articles; the large number of references to articles of less importance, especially to those in inaccessible foreign journals, will be reduced; articles belonging more particularly to the science of pure physics, chemistry, mechanical engineering, medicine, etc., rather than to that of electricity, will no longer be noticed.

Note.—Typewritten copies of any of the articles referred to in the Digest, will be furnished at the rate of 5 cents per 100 words for English matter, and 8 cents per 100 words for matter in foreign languages; translations at the rate of 40 cents per 100 words. Copies of any of the journals may be ordered; address Branch Office, ELECTRICAL WORLD, No. 927 Chestnut Street, Philadelphia, Pa.

DYNAMOS, MOTORS AND TRANSFORMERS.

Multiple-Current Dynamo.—In a short article in the Lond. "Elec. Rev.," June 28, by Mr. Kennedy, he points out the advantages of this "long-neglected class of dynamo" and describes a system of his own design; he claims to have been the first to have constructed and patented the multiple-current dynamo in 1882 and thinks that present progress renders such a machine a necessity. For most isolated electric plants a common constant-pressure 110-volt dynamo is not sufficient when motors, arc and incandescent lamps are to be used. If in a four-pole dynamo, instead of having the poles alternate, they are excited so that two consecutive poles are north and the other two south, then such a machine becomes a multiple-current dynamo, if provided with four brushes, the voltage between the two brushes which lie between poles of opposite polarity will be twice as great as that between either of these and the other two (which are connected together); the latter may therefore be connected to the middle wire of a three-wire system; these neutral wire brushes, which lie between similar poles, set up no disturbances in the field and are sparkless as long as the load on each side is fairly balanced; similarly a five-wire system can be formed by having three pairs of poles and five sets of brushes. The coils sweeping across the gaps between the similar poles are not generating any voltage, therefore the corresponding brushes cause no trouble by their short-circuiting these coils.

Rotary Current and Alternating-Current Dynamos.—A translation, with illustrations, of the article by Mr. von Dobrowolsky, which was abstracted in the Digest, March 9, April 20, is published in the Lond. "Elec. Eng.," June 28.

LIGHTS AND LIGHTING.

Train Lighting.—The articles by Mr. Weekes are concluded in the Lond. "Elec. Eng.," June 28; he gives a detailed illustrated description of the "penny-in-the slot" system used on the London District Railway. Each compartment has its own accumulators but they are all connected in parallel; the batteries are charged at least once a week; figures for the actual cost of maintenance cannot be obtained. In discussing the cost of electric train lighting he states that few figures are available; on the London & Brighton line some 140 trains are lighted and the annual cost per train is given as $270, no charge being included for the extra cost of coal on the locomotive; on the Great Northern Railway it is $750, the great difference being explained to some extent by the fact that fewer trains are lighted and the candle-power per train is greater; the average cost per kw-hour throughout the year was only 14.5 cts.; in three of the largest lighting schemes the average life of the accumulators ranges from 2.5 to 3.5 years, thus forming one of the largest items in the annual cost; besides renewing one third of the batteries each year, there is the cost of examining and nursing sick batteries. He recommends using steam from the locomotive to drive the dynamo instead of driving it from the axle, believing it to be the cheapest and best way; the first cost would be considerably reduced and batteries of only small capacity would be required as they would be needed only while the engines were being changed; this system was tried on the Great Eastern Railway many years ago, but was abandoned on account of the uneconomical engine used. A summary of the recent figures given by Mr. Leonard regarding train lighting in America, is given.

In an article in the same journal by Mr. New describing the I. E. S. (Buckland) battery (see Digest, May 18, July 6) he gives the cost per year of lighting the cars on the N. Staffordshire line; the complete battery for each car weighs about 54 pounds and has a capacity of 40 ampere-hours at 16 volts; 800 watt-hours are required for a charge of the battery; a discharge will give 17 cp distributed in different lamps for 11.5 hours the cost per car per hour being 0.3722 cts.; he assumes 2,000 working hours per year; the company pays 62 cts. per week per car as hire which he adds to the above cost, adding also 5 per cent. for interest on the capital.

Incandescent Lamps.—A device invented by an Italian is illustrated in the "Elec. Rev.," July 10, and consists in placing a round, flat mirror inside of the globe at the place where the filament ends, thus reflecting the light which would otherwise be obscured by the base of the lamp. In "El'ty," July 10, Mr. Lutz calls attention to the shocks received in using lamps connected to a three-wire system, while handling grounded machinery, owing to the fact that the neutral wire is grounded; to overcome this he suggests that care should be taken to see that the wire which is in contact with the outside of the base of the lamp, is the neutral wire (this of course applies only to three-wire systems in which the neutral wire is grounded).

Successful Municipal Lighting Plant.—A correspondent to the "Eng. News," July 11, states that a prosperous Illinois city has operated a 100-arc light plant including every item chargeable to the lighting fund, at a net cost of less than $41 per annum; (neither the name of the city nor that of the writer is given.)

POWER AND HEAT.

Electric Crane for Railway Stations.—The Lond. "Engineering," June 28, published an illustrated description of an ingenuous form of traveling crane which was recently erected at a passenger station in Manchester; it consists of a motor and windlass traveling on two suspended overhead tracks running through the train shed perpendicularly to the direction of the trains; the operator accompanies the crane; it lifts a large basket truck containing baggage unloaded from trains and carries it to another train or to the end of the station; surprise is expressed that the device has not been thought of before, and it is believed to be considerably cheaper than the elevators and subways now so often used for transferring baggage.

Power Bridge at Buffalo.—According to the "Elec. Eng," July 10, U. S. Engineer Major Ruffner disapproves of the Mather scheme (see Digest, June 29), on the ground that it would obstruct navigation; he believes the government would not allow the bridge to be built; while the plans are good ones for developing power, he would be compelled to report against allowing such an obstruction in the river.

TRACTION.

Central London Railway.—The "Lond. Elec. Rev.," June 28, gives briefly some data from the prospectus of the company which is again endeavoring to promote the construction of this road, a brief account of which was given in THE ELECTRICAL WORLD, July 25, 1891; it is to be an underground electric road somewhat like the well-known City & South London line, and is to run east and west through the city under some of the most frequented streets, beginning at Liverpool Street and ending at Shepherds' Bush, a distance of 6.5 miles; it will consist of two separate parallel tunnels throughout its entire length; there will be 14 stations; a public subway will be built for foot passengers in connection with the Bank stations which will give access to that station from a number of different streets; trains will be run at 2.5 minute intervals and the speed will be 14 miles per hour including stoppages; it is estimated that from seven to eight million passengers will be carried per mile per year, which is much below the carrying capacity of the line (that of the Third Avenue line, New York, for the year ending June, 1894, was about 8,500,000 per mile); the total working expenses are estimated at a maximum of $750,000 per year; the average receipts per passenger is estimated at 4 cts. and at the above working expenses there would be sufficient profit to pay 4 per cent. on the stock, 5 per cent. on the share capital, with a margin of over 1 per cent.; it is expected to be in working order at the end of the year 1898; the capital stock of the company is $14,250,000.

The Lond. "Elec." states that the cost of construction and equipment of the City & South London line was less than $1,500,000 per mile while that of this line is to be about $2,500,000, and it questions why there should be such a great difference, claiming that an increase of 15 per cent. in the diameter of the tunnels cannot be responsible for an increase of 75 per cent. in the cost of construction and equipments.

Self-Propelled Vehicles.—In a short article by Mr. Hospitalier in "L'Ind. Elec.," June 25, referring to the recent competitive tests made over the route from Paris to Bordeaux and back, he gives a good discussion of the relative merits and spheres of the different systems. Electric carriages run with accumulators are not satisfactory for long distances between large cities nor for great speed over great distances;

their proper sphere is the same as that of carriages drawn by horses, returning to their station daily, where they may be recharged during the night, and they are intended for passenger traffic only; for merchandise the place is already well filled by the gasoline carriages; such motors of two to five hp use about 500 grams of the liquid at a density of 0.7 per mechanical hp-hour at the wheel axle; taking into account the efficiency of the transmission, one kg of gasoline represents at least 250,000 kg at the wheels. With steam carriages one kg of good oil produces a maximum of six kg of steam, and engines without condensation require at least 18 kg of steam per hp-hour and three kg of coal; one kg of coal therefore produces at least 50,000 kg at the wheels taking into consideration the transformations. An electric accumulator gives as a maximum 15 ampere-hours at two volts representing 5,000 kg at the wheels (but he does not say under what conditions; presumably he means per kg of coal). The weight of gasoline, steam and electric motors as also that of the transmission mechanism for equal power are about the same, but the gasoline motor requires cooling water, the steam motor a larger quantity of water, while the electric system requires an accumulator of great constant weight; the figures 250,000, 50,000 and 5,000 therefore do not represent the respective values of the mechanical energy used in the three systems; a more rigorous comparison would lower the relative value of steam and raise that of gasoline; there is therefore really no rivalry between the gasoline and the electric systems in the above-mentioned competitive trials; there are a number of inconveniences in connection with the steam and gasoline systems; with all due credit to the success of the gasoline system, electric carriages offer such advantages as comfort, convenience and simplicity in operation, etc., that he believes them superior for service in a large city provided with sources of current; they solve best the problem of the electric cab.

According to the Lond. "Elec. Rev.," June 28, there were 27 competitors in the recent trials, one was electric, five steam and the rest gasoline, the prize being won by one of the latter holding four people and the race was won by a similar two-place vehicle which ran 1,178 km in 48 hours and 48 minutes. The electric carriage was of the Jeantaud type (see Digest, Feb. 16, 23 and March 2), with four seats and a 15-hp motor with carbon brushes, 38 cells of 25 kg each giving 210 ampere-hours. The electric carriage has the advantage over those driven by gasoline in that it is safe from the fearful risk of fire which accompanies the latter; collisions, which are unavoidable, would therefore be quite dangerous.

Illustrations of some of the carriages which were entered in this race are published in the "Elec. Jour.," (Chicago), July 1.

Accumulator Traction.—In a paper by Mr. New in the Lond. "Elec. Eng.," June 28, describing the I. E. S. (Buckland) storage battery (see Digest, May 18, July 6), he gives the following figures: a positive plate having 30 sq. in. of active surface on each side has a capacity of 30 ampere-hours and a discharge of five amperes and weighs 30 oz.; 900 watt-hours storage capacity corresponding to one hp-hour, involves a weight of 28 pounds; adding the negative plates the total weight (nothing is said of the jar, acid and accessories) necessary for one electrical hp-hour is 61 lbs. for a discharge lasting six hours; he estimates that seven hp will be required during six hours, making a total weight of 27 cwt., for five miles an hour it would run 30 miles at 1.4 hp-hours per car mile; allowing 30 per cent. loss in storage and 20 per cent. in motors and assuming the cost of an electrical hp (presumably per hour) to be 4 cts., the actual cost of current per car mile equals 8.064 cts.

Weight of Accumulators for Traction.—"L'Ind. Elec.," June 25, contains an article by Messrs. Chenet and de la Tour, in which they deduce a comparatively simple formula giving the weight directly, and taking into account the grades (while the formula with its deduction is of interest, it is hardly likely that it will be of any great value nor find general application, on account of the large number of variable factors which enter).

Street Railway Statistics of the United States.—The "St. Ry. Jour." for July publishes a full-page table of statistics giving the totals for each State; it is claimed that they are probably correct within 5 per cent. of the totals, and within 10 per cent. for the separate States; these figures are claimed to represent the latest data obtainable. The totals for the U. S. are as follows: 976 roads, 1,914 miles of track for horse traction, 10,363 for electric, 632 for cable and 679 for miscellaneous, making a total of 13,588 miles; 44,745 cars averaging 3.29 per mile of track; $748,014,206, total capital stock averaging $55,000 per mile of track; $552,125,505, total funded debt or $40,600 per mile of track; $1,300,139,711, total capital liabilities or $95,600 per mile of track.

Three-Phase Railway System.—According to the "St. Ry. Jour." for July, the first application of the three-phase long-distance system for railway work will be made by the General Electric Company, at Lowell, Mass.; the generators will deliver both alternating and continuous currents and when not in use for transmission work will be run in parallel with the railway generators now in the station; the low-voltage alternating current will be raised to 5,000 volts and carried to two sub-stations, nine and 14 miles distant, where it will be received in transformers and rotary converters and sent to the line at 500 volts; a transformer sub-station for 400 incandescent lamps will also be installed six miles from the generators.

Electrolytic Corrosion.—The "Elec. Ry. Gaz.," July 6, gives the opinion of the subway commissioners of Brooklyn regarding the situation in that city. They state that serious injury is being done to the water mains belonging to the city by the return railway currents; the method suggested in a recent report (presumably referring to that of Prof. Barrett, abstracted in the Digest, Feb. 9), was applied to one line and proved effective; where there was corrosion in November last, there is none now; the proposal of the trolley company to apply the same remedy in other places is met by the refusal of the commissioner of city works on the ground that it would imperil the claim of the city for damages upon the trolley companies, if the method should cease to be effective in the future; it cannot be affirmed that the remedy once applied is good for all times; the trolley companies must now rely upon other methods such as welding of the rails, using heavier bonds or making frequent connections between the rails and a return conductor; these have been used with various degrees of success but in many places the current still passes through the pipes.

Electric Yacht.— A short description of Mr. Astor's yacht is published in the "Elec. Rev.," July 10. It is 47 ft. long over all, and the draught at the screws is 2 ft. 2 in.; it has a twin-screw apparatus, each with a separate direct-connected motor supplied from an independent group of batteries, and regulated by two controllers placed near the steering wheel; the "Chloride" accumulators are used and number 168 cells of a capacity of 150 ampere-hours at a 10-hour discharge; the maximum hp developed for continuous work is 10 while 30 hp is available for short spurts; it requires five to seven hours to charge the batteries at a cost of 84 cts. an hour; a speed of 15 miles an hour can be developed for a short distance; at a 10-hour rate of discharge, a trip of 75 miles can be made.

Lowell, Lawrence & Haverhill Railway.—An illustrated description of this system, comprising 56 miles of track, is published in the "St. Ry. Jour." for July; General Electric machinery is used.

Freight Traffic on Electric Railways.—The "Eng. News," July 11, publishes illustrations with brief descriptions of a number of freight and combination cars at present in use on electric railways.

Accumulator Traction.—The curves and detailed data showing the amount of energy returned to the batteries on the Paris line in going down grade, the data of which was abstracted in the Digest, June 1, are published in the "Elec. Ry. Gaz.," July 6.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Gas Engine Stations.—The Lond. "Elec.," June 28, begins an article on this subject which is intended to give the results of a tour of inspection of such stations in Great Britain and Ireland, for the purpose of making a comparative study. The general impression received from such a tour strengthened and deepened the faith of that writer in the ultimate success of this type of station; gas power in electric supply stations has not only proved itself to be an established commercial success but it has also given good grounds for believing that it can be made increasingly successful. The well-known advantages of using gas power are enumerated and discussed; a brief description is given of the Dessau station in Germany, which was the first important one of this kind and was started in 1886. Mr. Lane's scheme proposed in 1891 is briefly described and discussed; he believed that a given amount of energy can be more economically transmitted over a short distance by gas fed through pipes, than by electrical means, and he therefore proposed to replace the central electric station by ordinary gas works, substituting gas mains for the electric feeders and placing gas engines at the sub-station, from where the energy could be transformed into electrical energy and distributed locally from low-pressure mains; he calculated that one hp of gas power would transmit enough gas for 3,000 hp over a distance which will cause a loss of gas pressure of four inches of water; this is equivalent to 300 hp for 900 cu. ft. of gas per hour transmitted one mile in a 6-in. main, the cost of such a main being estimated at $1,760 per mile plus $660 for laying; from the interest and the cost of gas (62cts.) he finds that the 300 hp is transmitted one mile at a cost of 0.2 cts. per hour; these figures are for coal gas and become considerably modified for diluted water gas; an application of this scheme in a modified form occurs at Belfast and another at Leicester, both of which stations have been described in The Electrical World. A table is given of the composition of a number of samples of city coal gas showing considerable variation; the average capacity of one pound corresponding to about 30 cu. ft. is about 22,000 thermal units (lb. Fah.) by complete combustion, corresponding to about 733 units per cu. ft.; this corresponds to about 1 cu. ft. per hour for 0.285 hp or one hp for every 3.51 cu. ft. of gas per hour, theoretically. Another table gives the average composition of Dowson gas; the theoretical volume of air required for its complete combustion is equal to that of the gas itself; the heat of one pound is 2,600 units and that for 1,000 cu. ft. is 177,500 units. The gas engine has both a high range of possible efficiency and a higher degree of realized efficiency, that of the modern gas engine being as high as 15 to 20 per cent. while a possible efficiency of 80 per cent. is claimed by some

writers. The well-recognized advantages of gas engines are given; the principal arguments advanced by opponents are: that such engines are not capable of sufficiently sensitive governing; that the engine is dirty in working and requires much labor to keep it clean; that it is unsatisfactory for steady driving; that it cannot be made in sufficiently large units; that it cannot be run economically on small fractions of full load; and that in populous districts it is too noisy; to what extent these objections are invalid will be shown in subsequent articles.

Accumulators in Central Stations.—In the discussion of Mr. Howell's paper (see Digest, July 6), Mr. Crompton was attributed with having made some remarks regarding alternating currents; in a communication to the English journals, June 28, he claims that these remarks give a totally false impression when read without others which preceded and followed them; he states that the outcome of the long conflict between continuous and alternating systems has been to show that however well suited alternating currents may be for power transmission, they are not well suited for the distribution networks, that is, from these distribution centres to the consumers' lamps; that this was on account of the very peculiarities inherent in alternating currents, which on account of the interesting problems involved has endeared them to the minds of professors and students, but which introduces a number of difficulties in giving a perfectly regular and steady light. He showed that the most successful way of dealing with these difficulties is to confine the alternating system to the transmission of energy up to the distribution point, to interpose the accumulators at this point, using nothing but continuous currents in the networks; the very latest and best continental practice pointed in this direction; he believes that alternating currents are playing and will play an important part in the electrical industry.

Charging Accumulators from Alternating Currents.—A recent paper by Mr. Pollak is abstracted briefly in the "Elek. Zeit.," June 20. He considers that alternating currents alone are suitable for transmission for great distances and he therefore emphasizes the importance of being able to convert alternating into direct currents; this may be done by means of his rectifier, which has already been described and which he suggests placing at the distant end of a line for charging accumulators; in this rectifier only a portion of the wave of current can be used, being limited to that during which the voltage is greater than that of the accumulators; the regulation of the exact point is accomplished by moving the brushes; the efficiency of the rectifier is stated to be 96 to 94 per cent. He states that such a current has the peculiar property of accelerating electrolytic processes, a property which has not yet been explained.

London Central Stations.—The Lond. "Elec.," June 28, published as a supplement a large double-page table giving the capital outlay, receipts and expenditures for 1894 of a number of the stations in London; some interesting comparative figures are given, but to abstract them might be misleading without giving all the necessary qualifications. The total capital outlay was $19,500,000, an increase of 11 per cent. over that of the previous year; the total output for the year was over 13,500,000 kw-hours, an increase of nearly 39 per cent., and this is undoubtedly less than the actual amount owing to some failure to make proper accounts; the average ratio of expenditure to receipts is about 63 per cent.; the average total cost of a kw-hour was reduced from 9.5 cts. to a fraction over 8 cts., notwithstanding the inclusion of the fatal figures of the London Electric Supply Company.

Cheap Electricity in Germany.—It appears that the station at Frankfort intends to supply current for power purposes at the very low price of 6.5 pfennig (1.63 cts.) per kw-hour; this price can be fixed because the demand on the station occurs at times when there is not much other work and when a heavier load favorably influences running; by such loads the working cost of the station per kw-hour is substantially reduced and this is a primary step toward cheapening the price of light. The cheapest electric power in Germany at present is that furnished by the Isar works near Munich, namely, 2.4 cts.; power is obtained from water.

Anticipation of the Monocyclic System in Europe.—Mr. Georges in the "Elek. Zeit.," June 27, claims that this system is precisely the same as that which has been used for some time in Dresden; the latter was suggested by Dr. Ulbrich toward the end of 1892 and the plant was installed by the firm of Siemens & Halske; in April, 1894, two sets of machines of 300 hp were started and this is the date of application of the Steinmetz patent; the system of circuits of the Dresden plant was described in 1893 or nearly a year before the application of these patents; he calls attention to a brief description of the system in THE ELECTRICAL WORLD, Nov. 3, 1894, page 469. (The Dresden installation was described in the Digest, Aug. 5, 1893; see also Feb. 18, 1893.)

Rules and Regulations.—A translation of some of the proposed German rules referred to recently, is published in the Lond. "Elec. Rev.," June 28.

Efficiency of Electric Plants.—Mr. Sprout begins a series of articles in the "Elec. Jour." (San Francisco) for July in which he intends to present data of different plants obtained by actual experiments under actual working conditions. In the present portion he gives detailed tabulated data for a lighting plant having both arc and incandescent lamps using about equal amounts of power; it contains two 90-hp steam engines; it is run with a load factor of 80 which explains why the figures representing the costs are so low (this load factor appears to be determined from the maximum and the average load for the few hours during which the station is being run and therefore does not include a 24-hour day); at a maximum load of 60 kw, which is not uncommon, the average load is 48 kw and the cost of producing energy per 50-watt lamp-hour at this stage of load is 0.48 cts., while in central stations having a maximum of 60 kw the average being 15 kw the cost will be 3.3 cts. per hour, showing that a station which can run only during the hours of heavy load in the evening has very great advantages in the way of economical operation over one that gives continuous service during the 24 hours.

Chicago.—A well-illustrated description of the station of the People's Electric Light & Motor Power Company in which Wood arc-light machines are used, is published in "Elec. Ind." for July; two of the dynamos have a capacity of 110 lamps each.

Light Installation of the Great Northern Railway, England.—An illustrated description from the London "Railway World" is reprinted in "Elec. Ind." for July.

WIRES, WIRING AND CONDUITS.

Aluminum-Copper Telegraph Wires.—According to the Lond. "Elec.," June 28, a recently tested wire containing 40 per cent. aluminum and 60 per cent. copper, had a resistance of 31.1 ohms for soft and 33.29 for hard-drawn wire, for a length of 1 km and "1 mm cross-section" (?) that for the same amount of ordinary copper wire being 16.45 ohms. The tensile strength of a wire of this alloy, 2.3 mm in diameter, averaged 17.78 tons per square inch.

ELECTRO-PHYSICS AND MAGNETISM.

Phase Shifting of Alternating Currents by Electrolysis.—In the Digest, June 29, an article by Mr. Peukert was abstracted, claiming to show that there is no phase shifting when an alternating current passes through an electrolyte. The "Elek. Zeit.," June 20, contains an article by Mr. Von Dobrowolsky showing that this is not correct; theory requires that when in any apparatus an E. M. F. is generated by the passage of a current, a phase shifting of the current as compared with the voltage, takes place; this he explains by stating that when a current produces an E. M. F. or polarization in any apparatus, whether a coil, condenser or voltmeter, the first result will be that a certain quantity of energy is stored in the apparatus; if then a change in the strength of the current takes place, as for instance a change in direction, the apparatus will discharge itself partially or completely, through the circuit; with an alternating current a certain portion of the energy transmitted will oscillate; the lower the resistance the less will be the difference between the energy which enters and that which is returned by the apparatus; he shows that the voltage can be divided into "the watt component" and "the wattless component" the former representing the energy and the portion of the current which is in phase with the voltage, and the latter that which is shifted by 90 degrees; the tangent of the phase difference is equal to the latter divided by the former. In an electrolytic cell there is a storage of energy in the form of polarization and on account of this storage there must be a phase shifting; the fact that there is a limit to the polarization voltage, equal to about 2.5 volts with platinum in assidulated water, does not alter the principle any more than the fact that there is saturation in an iron core in a coil. As theory requires this phase shifting, a single experimental determination of its absence is not conclusive; there is a want of data concerning that experiment and he shows that if the voltage had been 50, for instance, and the polarization 1.5 the sine of the angle of phase difference would be only 0.03 which would be so small that it would be difficult to detect. To obtain a large value the apparatus must consume very little energy; but the reduction of the resistance must not be produced by increasing the size of the plates as that will increase the amperes required to produce polarization; it should be produced by approaching the plates or increasing the conductivity of the liquid; by doing this, very great phase difference can be produced, sufficiently so to use the apparatus in practice; batteries made with iron plates with soda solution produce a phase shifting of 80 degrees; an alternating-current machine with small excitation connected to a polarization battery readily produces an increase of voltage of 50 to 100 per cent.; with certain combinations it is possible to cause a machine to fall out of step with its own current, just as was the case in the famous Lauffen-Frankfort transmission plant.

In the issue of June 27 Mr. Eisler states that this subject has been treated theoretically and experimentally a number of times since it was first pointed out in 1873, and that all these have confirmed the theory of the existence of a phase difference; every decomposition cell in which a counter E. M. F. is developed acts as a condenser of variable capacity.

Experiments with Electromagnetic Magnetism.—In an article by Mr. McMahon, in the Lond. "Elec.," June 28, he describes researches made to arrive at an electromagnetic apparatus like an ammeter or voltmeter, capable of moving over a wide range with considerable force and responding instantaneously to any variations and to give a directly proportional reading; the results were not altogether satisfactory. In the present portion he describes those made with a simple solenoid and core, giving dimensions and data; the results so far do not appear to

have great value; when the solenoid was ironclad the travel for the same weight was reduced and was more nearly proportional to the ampere turns; the introduction of an iron jacket always made the arrangement more sluggish, especially for greater exciting currents; he found that as the load increased the required variations of exciting power increased in direct proportion, or the ratio of variation to load is practically a constant. Editorially the suggestion is made that closer proportionality might be attained by "the application of a graphic construction to connect the shape of the core with the width of gap in the magnetic circuit and the saturation of the core, so as to make the travel for a given controlling force proportional to the ampere-turns"; his experiments seem to show that no part of the traveling core ought to be cylindrical.

Chemical and Optical Action of Cathode Rays.—A paper by Dr. E. Wiedemen is briefly abstracted in the "Elek. Zeit.," June 20. He credits the priority of the discovery of the light phenomena in vacuum by high-tension discharges, to Hittorff instead of Crookes, and discusses the nature of luminescence phenomena, that is, the glowing of bodies without being accompanied by high temperature; they may be explained either physically as oscillations or chemically and he favors the latter, partly because the glowing may continue for a very long time and is greatly increased by the addition of heat; the fact that chemical changes have not been noticed, he explains by saying that the amount of energy is extremely small. Regarding the efficiency of this method of producing light he suggests that it may not be as high as is generally supposed, as his researches have shown that besides light and cathode rays, a third kind of radiation is produced which is inactive optically, analogously to the invisible heat rays from ordinary sources of light.

Periodic Functions Developed in Fourrier Series.—In a short article by Prof. Perry, in the Lond. "Elec.," June 28, he describes a graphical method which he believes to be very simple and rapid, while it is very accurate if drawn to a sufficiently large scale; the article does not admit of being abstracted. Editorially, belief is expressed that this elaboration of curves is not likely to find general use in engineers' offices.

ELECTRO-CHEMISTRY AND BATTERIES.

Seat of E. M. F.—A recent paper by Prof. Ostwald is briefly abstracted in the "Elek. Zeit.," June 20. After discussing a number of theories he describes the following experiment: a drop of mercury in a watch glass is covered with sulphuric acid and bichromate of potassium and is then touched by means of an iron point; the mercury then contracts suddenly after which it expands again, bringing it in contact with the iron which again causes contraction and so on, the result being an oscillating movement which is readily seen when projected on a screen. He explains the action by saying that between the mercury and the electrolyte there must be a difference of potential and the surface of junction may therefore be considered as a condenser between which electrostatic forces are acting; these tend to flatten the drop of the mercury, acting against the surface tension; when the charge is equalized by the iron the drop will again assume its former spherical state. He considers this a proof of the presence of an E. M. F. on the surface of separation between the metal and the liquid; there remains to be shown only that the other contacts in the circuit are passive; researches which he made show that the E. M. Fs. of contact of metals are at the highest in the range of millivolts, as distinguished from the values in the Volta series in which they are in the neighborhood of one volt.

Oxy-hydrogen Accumulators.—Mr. Warren, in the "Chem. News," June 28, describes some experiments with a modified Grove gas battery in which he used a platinum plate in the oxygen gas and one of palladium in the hydrogen gas; "several cells thus arranged in series have been found to produce a mean voltage of 0.45 while by rendering the surface more active even 0.5 had been attained, a series of five such batteries being capable of decomposing water" (although not so stated it appears the above is the voltage of each of the cells). Subjected to 180 atmospheres the gases unite with great violence, whereas by increased surface action they combine at diminished pressure; to increase the surface of the plates, graphite plates were used, some platinized and others palladiumized and enclosed in small canisters lined with lead; at two atmospheres the gases were somewhat quickly absorbed, an increase of every two atmospheres increasing the volt by about 0.15 volts until 1.0 and even 1.25 volts were attained. Experiments are being made for maintaining a steady pressure and rendering the apparatus less explosive; "when this is accomplished together with the removal of other small difficulties which still exist, it will probably be possible to construct a self-charging accumulator"; what the latter clause means is not explained.

Chemical Action in Accumulators.—In a paper by Prof. Elbs, briefly abstracted in the "Elek. Zeit.," June 20, he claims to have proved that per-sulphuric acid cannot be the cause of the formation of peroxide of lead, as this can take place only in neutral solutions which never exist in accumulators.

Autogenous Soldering for Accumulators.—The Lond. "Elec. Rev.," June 28, gives an illustrated description of a plumber's outfit, taken from a work on sanitary plumbing, of a convenient form of self-acting and self-regulating hydrogen generator, and rules for using it.

Reactions in Accumulators.—In the Lond. "Elec.," June 28, Mr. Cooper gives a brief summary of the theories of Streintz and of Darrieus, both of which have been described in these columns.

Nitrous Acid in Batteries.—According to a recent paper by Dr. Ihle, mentioned in the "Elek. Zeit.," June 20, nitrous acid (salpetrige Saeure) plays a very important part in the Grove cell; if in such a cell the nitric acid is so diluted that scarcely any current is noticeable in a galvanometer, and if then a few hundredth of a per cent. of nitrous acid are added, a large defection will be noticed in the galvanometer.

Multivolt Battery.—Prof. Anthony, in the "Elec. Eng.," July 10, states that Mr. Johonnot (see Digest, June 22), ignores the fact that there are potential differences between the several carbons and between the several zincs as well as between zinc and carbon and that his theory therefore leads him to totally wrong conclusions; he claims that Prof. Carhart (see Digest, June 22), in stating that the most important leakage is between the zinc connected to the negative pole and the carbon connected to the positive, overlooks the E. M. F. of the cell; there is a voltage between the carbon of the cell at the negative end and the zinc of that cell and when the cell is in action current flows through the liquid from the zinc to carbon against the potential difference and there is therefore no greater effective voltage between the zinc of the cell at the negative end and the carbon of that of the positive end; although the leakage would be smaller, for, with a low external resistance, the battery would then be a very inefficient combination as the cells for such use should be joined in parallel and not in series, and the idea of joining the cells as they are is to overcome a considerable resistance. He calculates that the resistance from carbon to carbon is equal to about three ohms and therefore the arrangement is equivalent to connecting the first and third carbons of a battery of three cells by a wire of three ohms resistance, the only thing gained being the facility in handling a larger quantity of liquid in one cell instead of three, but he believes that as a result of local actions it would be necessary to replace the liquid twice as often. He explains how he calculated the resistance mentioned above; with such a resistance, the leakage current would be one ampere, a current equal to the useful current which should be taken from the battery if it is to be used with any regard for efficiency.

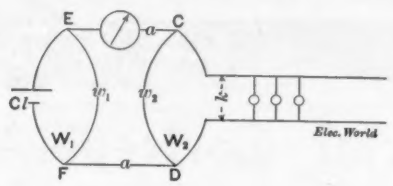
Aluminum Manufacture.—The "Eng. & Min. Jour.," June 22, gives a brief description of a new process patented by Mr. Hall. Aluminous earth is treated with sulphuric acid forming a sulphate which is decomposed by heat, yielding aluminum oxide, which is reduced by electrolysis, the bath being formed by fusing together aluminum chloride, sodium chloride and lithium chloride, the aluminum oxide being supplied by the decomposition of the anode of which it forms a part. It has been in use for some time and is said to be quite successful although the results are not yet made public. The crucible is preferably made of carbon and alumina enclosed in an iron envelope; the anode is made of carbon and aluminum oxide intimately mixed and adjusted in a vertical position; this anode is decomposed by the current, the alumina being released, diffused and then reduced, the oxygen collecting at the positive electrode where it combines with the carbon setting free more aluminum oxide, the whole operation being automatic if the position of the anode be properly regulated; if the quantity of alumina is sufficient the gas liberated is carbonic anhydride. Chloride baths may be advantageously used to produce aluminum alloys if used with a fused negative electrode of the metal to be alloyed. The flux forms an important part and affects the efficiency; the metal was reduced at the rate of 0.6 pounds per hour requiring not more than 8 kw-hours per pound. A provisional plan for a factory is given briefly.

Metallurgy of Gold.—The "Elec. Jour." (San Francisco) for July states that a new process which is said to be very cheap is soon to be started at Cripple Creek, Col. It is called the "Electro-Chlorination Process"; a portion of it is kept secret. A strong current at low voltage is passed through the crushed ore immersed in a solution of sodium chloride, separating the sodium and chlorine, the latter uniting with the gold and forming chloride of gold which deposits on a sheet of lead or other suitable cathode. The bottom of the vat is lined with blocks of carbon forming anodes, the cathode being at the surface of the liquid; a dynamo with an output of 6,000 amperes at 30 volts will be used and it is claimed that on ton-lot experiments, 94 per cent. extractions have been made in 45 minutes. The secret consists in the use of an ingredient which when added to the solution is said to prevent the liberated sodium from re-uniting with the chlorine.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Apparatus for Exact Measurement of Voltage, Current and Resistance.—In the "Elek. Zeit.," June 27, Mr. Thiermann explains in detail with the aid of a clear illustration an apparatus intended for accurate measurement but capable of ready and easy application. It is based on the use of a Clark cell on closed circuit and in order to be assured that such a cell can be relied upon under such circumstances, he connected one of two similar cells to a resistance of 100,000 ohms continuously for 46 hours and compared it with another cell on open circuit; he thus showed that a current of 10 to the minus 5th power ampere, may safely be

taken from such a cell if an accuracy of no more than one part in 2,000 is required; (but he does not give the size of the cell, simply saying that it is one of the older types). The method of measurement in his apparatus is shown diagrammatically in the adjoining figure and is called



by him the "double-loop method"; the first loop to the left contains the Clark cell and a resistance of about 143,000 ohms, the other loop to the right, containing the voltage to be measured, has a total resistance of 200,000 ohms; if two points on the one circuit are connected to two points on the other as shown at *E*, *C*, *F*, and *D*, the two resistances indicated by *w* can be so chosen that the voltage at their terminals is the same and there will therefore be no current in the galvanometer; the voltage in the right-hand loop can therefore be readily determined; the accuracy of the method is one part in 2,000. The complete apparatus which is described in detail, includes a series of resistances which are calibrated so as to correct for the temperature coefficient of the standard cell. He shows that for this degree of accuracy it will be sufficient to have a galvanometer whose sensitiveness corresponds to 10 to the minus 8th power ampere, for 1 mm deflection at 1 m scale distance; a good Deprez (doubtless meaning a d'Arsonval) galvanometer is therefore sufficient; for voltages below 0.01 the galvanometer resistance should not be greater than several hundred ohms. If the Weston cadmium cell has all the qualities claimed for it, the temperature correction is not necessary, which simplifies the apparatus.

Magnetic Symbols and Terms.—The Lond. "Elec.," June 28, contains a communication from Messrs. Houston and Kennelly in which they take exception to some recent criticisms in that journal. They state that they did not select the symbols and that they were recommended by the recent congress and have since come into extensive use in the United States and France; concerning the use of the word "gauss," they claim that if the word were more generally used it would render impossible such a misconception as is contained in that criticism, in which it is claimed that they use it for both $\mathfrak{H}$ and $\mathfrak{B}$ although these two quantities are as distinct from one another as amperes are from volts; to this they reply that the unit of magnetizing force $\mathfrak{H}$ and of magnetic flux intensity $\mathfrak{B}$ are essentially the same physical quantity, having the same conventional dimensional formula and are therefore properly designated by the same name; they fail to see why it is supposed that $\mathfrak{H}$ is less readily measureable than C; the earth's magnetic force for instance is measured in many parts of the world; if the definite name "gauss" is used instead of the indefinite "C. G. S." the confusion between the natures of the fundamental magnetic quantities as that into which their critics appear to have fallen, would, they believe, be prevented; it could not fail to impress the fact that magnetizing force, field, intensity, and magnetic induction are of the same physical quantity differing only in direction and magnitude, from whatever source they may be derived. Mr. Wolcott in a communication in that journal agrees with the editorial remarks; he states that the well-known table published by THE ELECTRICAL WORLD gives the name "gauss" for magnetic induction, magnetic field intensity and magnetizing force; while the second and third are related like E. M. F. a difference of potential, the first is a different quantity.

In an editorial reply the view is held that the misconception is with those who regard magnetizing force and magnetic flux as essentially the same physical quantity; in the electromagnetic system of units, the dimensions are identical but this is because the dimensions of permeability are ignored, just as in the electrostatic system, those of specific induction capacity are omitted; it is quite arbitrary to neglect their dimensions and look upon those quantities as mere numbers; in the electromagnetic theory $\mathfrak{B}$ and $\mathfrak{H}$ have to be regarded as distinct physical quantities with different dimensions, for it is impossible any longer to neglect the physical natures of permeability and specific induction capacity. Concerning the remarks about the measurement of $\mathfrak{B}$ and $\mathfrak{H}$ they stated that the former can be measured but that the latter is estimated from the flux of induction which it produces, a legitimate process, but the quantity primarily measured is $\mathfrak{B}$ and not $\mathfrak{H}$; volts are usually measured by the current which they produce but this does not make it legitimate to regard a volt and an ampere as the same kind of a quantity.

Capacity of an Electrostatic Voltmeter.—The Lond. "Elec. Rev.," June 28, contains a short article by Mr. Campbell in which he gives the results of some measurements made some years ago of the capacity of a Ayrton-Mather electrostatic voltmeter. The instrument was virtually a quarti-cylinder electrometer, with a vertical axis and a controlling spring; it reads up to 4,000 volts and the measurements were made at different voltages; for a standard of capacity he used a metal sphere 8.8 cm in diameter suspended by silk threads; its capacity was taken as 8.8 electrostatic units, that is, about 9.8 multiplied by 10 to the minus 6th power, microfarad. The test consisted of two parts, in the first the sphere and the voltmeter were joined and charged, the voltmeter being then disconnected, discharged and again joined to the sphere, their common potential being then read on the voltmeter; in the second part the voltmeter was charged and then made to share its charge with the insulated sphere, which was at zero potential. A table of the results gives the capacities at different voltages; at 500 volts it was 8.05 multiplied by 10 to the minus 6th power, in microfarads; for 2,000 volts this constant was 11 and for 4,000, 11.9; the results must be taken only as approximations. Such an instrument therefore affords a means of measuring small capacities without the aid of a condenser or any other instrument except some means for obtaining small charge.

Meter Trials in Paris.—According to the Lond. "Elec. Eng.," June 28, certain meter trials were recently made by a French commission, being confined to the meters used in Paris. Observation of about 500 Thompson meters in service showed that there were 4.5 per cent. of failures of which 2 per cent. were due to dust on the disc, 1.5 per cent. to loosening of the endless screw and 1 per cent. to various causes; the Aron meter requires great care in its construction and many precautions have to be taken in using it; failures amounted to 15 per cent., but it has given very satisfactory results; the Frager meter presents many inconveniences; the Brillie instrument gave good results in practice but necessitates much watching and is very delicate; the Dejardin meter, which is said to be very simple, has been working with regularity; the commission complains that the makers are not exercising as much care in turning out later instruments as they used in the first meters made for trial.

Lumen-meter.—An illustrated description of the Blondel instrument (see Digest, June 29), is published in the Lond. "Elec. Eng.," June 28.

Measuring Specific Inductive Capacity.—A translation of the article by Mr. Nodon, which was abstracted in the Digest, June 8, is published in the Lond. "Elec.," June 28.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Express Switchboard.—The "Elec. Jour." (San Francisco) for July (Vol. I., No. 1) contains a long and well-illustrated article by Mr. Low on "Modern Telephone Exchange Systems," describing the "Express" switchboard which has been in use in San Francisco for nearly two years where it replaced the "Multiple" system which was abandoned at that time. The distinguishing feature of this system is that the switchboard is split into two sections each independent and different in design from the other and each performing a separate and individual function; the two sections are distinguished as "A" and "B" boards, respectively, the same designation being followed through all the features, as for instance, A and B operators, trunks, subscribers, etc.; an A subscriber being a calling or incoming one and a B subscriber being a called or outgoing one; it is on the distinction between these terms that the basis of the system rests.

MISCELLANEOUS.

Purifying Carbon.—In an Academy note by Mr. Deslandres, abstracted briefly in "L'Ind. Elec.," June 25, on the study of the spectrum of carbon from the electric furnace, he stated that Moissan has found that the carbons used in his electric furnace are purified by the current, being freed from foreign materials; in the present note it is shown that samples taken from different parts of the carbon show that the impurities are diminished and finally disappear toward the points of the carbons, the purest carbon being that in the mushrooms which form on the negative pole by the transportation of carbon from the positive; he obtained the spectrum of this carbon and gives the results.

Singular Effect of a Lightning Stroke in Chicago.—Prof. Stine in the "Elec. Eng.," July 10, calls attention to a peculiar case in which a factory building was struck by lightning, some 50 feet of insulated wire, one drop cord and pendant and a switch box being destroyed and other damage done; the outside diameter of the wire was 3-16 inch; it was a No. 14 wire enclosed in a layer of white rubber covered with one of black rubber and again by a protecting braid, insulating compound, and finishing varnish; after the discharge the wire was only a tube, the copper for the most part having disappeared; the outside showed the effect of heat; at irregular intervals there were openings; only in a few places did the rubber core show traces of burning; there were scarcely any traces of copper markings that would indicate that the wire had been vaporized; the conductor was found scattered about the floor in pieces one quarter and three quarter inch in length and quite regular; the wire seems to have literally shot out from the insulation as from a gun; the uniformity of length of these pieces is significant; when a long fuse wire is blown, it invariably breaks into a number of pieces of quite uniform length indicating some form of rhythmic action; the faces of the ends are square and chrystaline, suggesting that the copper was fused internally and cooled rapidly when exposed to the air; only occasional pieces of wire were found in the inner tube but they were of uniform length with those that had been injected.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, July 13, 1895.

AMERICAN BELL displayed rather more strength this week than last, opening at 194½ on Monday and closing to-day at 197.

GENERAL ELECTRIC continued in sympathy with the general line of industrials, which were subjected to vigorous bear attacks. Opening at 37⅛ on Monday, the stock immediately began to weaken, and gradually fell to the closing figure of to-day.

THE TRACTIONS all remained steady and substantially unchanged. Baltimore and People's Tractions have both made splendid showings since the opening of Spring, and the stocks reflect the results obtained in the operation of the systems.

	Par.	Bid.	Asked.
ELECTRICAL STOCKS.			
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	101¼	101½
" " " Brooklyn	100	..	108
" " " Boston	100	129	130
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	28½	29¼
General Electric	100	35¾	36
General Electric, pref	100	69	71
Westinghouse Consolidated, com.	50	35	36
" " pref	50	53	54
BONDS.			
Edison Electric Ill., New York	100	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co. deb. 5s	100	..	90¼
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	194	194¾
American District Telegraph	100	30	40
American Telegraph & Cable	100	94	97
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	57½	57¾
Gold & Stock Telegraph	100	105	..
New England Telephone	100	..	77
New York & New Jersey Telephone	100	103	105
Postal Telegraph-Cable	100	63⅜	..
Western Union Telegraph	100	91⅜	91⅜
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	20⅝	20⅞
Binghamton RR. com	100	100	..
Brooklyn Traction	100	16½	18
" " pref.	100	..	58
Buffalo St. Ry	100	86	90
Cleveland City Ry.	100	68	70
Cleveland Electric Ry.	100	59	60
Chicago City Ry	100	305	315
Columbus St. Ry	100	48½	..
Consolidated Traction of N. J	..	26	30
‡Electric Traction, Philadelphia	50	72	72¾
Hestonville	100	59	60
Long Island Traction	100	10	10¼
Louisville St. Ry. com.	100	37	39
" " " pref.	100	87	887
New Orleans Traction	100	24	24½
" " pref.	100	69	71
North Shore Traction	100	34½	37
" " pref.	100	84	88
People's Traction $30 pd	25	61½	61⅞
Philadelphia Traction	50	82½	83¼
Rochester St. Ry	..	38	..
Union Ry. (Huckleberry)	100	112	115
West End, Boston	100	72½	73
" " pref	100	..	20
Worcester Traction	100	18	20
" " pref	100	86	90
BONDS.			
Buffalo St. Ry. 1st con. 5s	100	106	108
*Binghamton Railroad Co. 5s	100	99	100
*Columbus St. Ry. 1st 5s	100	104	..
Rochester St. Ry. 1st. 5s	100	95	97
*Union Ry. 1st. mtge 6s	100	105	108
*Westchester Electric 1st. mtge. 5s	100	98	101

* With accrued interest.
† Ex-Div.
‡ Ex-rights.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
253 BROADWAY, NEW YORK, July 13, 1895.

DIVIDEND.—The directors of the Brooklyn City Railway on Thursday declared a 2½ per cent. dividend out of the road's surplus account.

MR. GEO. A. McKINLOCK, the genial president of the Central Electric Company, Chicago, accompanied by Mrs. McKinlock, is enjoying a holiday in the East.

MR. FELIX HAAC, president of the American Silk Manufacturing Company, spent a few days in New York last week looking after the interests of his company. Mr. Haac reports that the sales of silk waste machine wipers to electric light and power plants are rapidly increasing.

ALBANY, N. Y.—It is reported that the Flint-Dutcher car fender which was recently tried on the Troy City Railway with successful results, has been given a trial by the officials of the Albany trolley system on upper Broadway, but the results have so far not been made public.

LENOX AVENUE CONDUIT SYSTEM.—The Metropolitan Street Railway Company's underground conduit branch extending from the Harlem River south through Lenox Avenue, thence west through 116th Street, and thence south through Manhattan Avenue to connect with the Columbus Avenue cable road at 109th Street and Columbus Avenue, was opened to the public on Tuesday last.

TROLLEY CAR MAIL SERVICE IN BROOKLYN.—Postmaster Sullivan, of Brooklyn, on last Monday organized a mail collection system for the Fifth Avenue trolley mail cars. Ten collectors will cover the district, and eight collections will be made daily. The collectors will place the mail bags on the cars in Atlantic and Fifth avenues, and the letters will be sorted during the trip to the postoffice.

NYACK TRACTION COMPANY FORFEITS ITS FRANCHISE.—The Nyack Traction Company obtained a franchise on March 8 for the construction of an electric road through Nyack, N.Y., and the terms of the franchise were that the construction of the road should commence on or before July 1, 1895 The company having failed to be in operation on the date mentioned, the village trustees directed the clerk to serve notice that its franchise had been forfeited.

NEWARK'S TRANSFER TROUBLES.—The contract between the Newark (N. J.) authorities and the railway companies stipulates that transfers shall be given to passengers between all lines within the city limits. The Consolidated Traction Company gives transfers, but requires passengers to ask for them before the car reaches the point of transfer or forfeit their right to continue the ride without additional fare. Conductors have their orders to this effect, but there is no announcement in the cars for the benefit of the passengers, so that those who are in ignorance of this rule must pay two fares if they should neglect to ask for a transfer before reaching the transfer point. This rule has been the occasion of severe criticism of the traction company by passengers, so much so that it is thought the Board of Street and Water Commissioners will probably take the matter up at its next meeting.

TROLLEY CAR SPEED ORDINANCE.—The Brooklyn Heights, the Atlantic Avenue and the Brooklyn City & Newtown Railway companies had an array of counsel in Judge Neu's court last week to make answer to the suit brought against the corporations by the city for violations of the speed ordinance. The municipality was represented by Assistant Corporation Counsel Angell. Messrs. Morris & Whitehouse, who appeared for the first two corporations, said that the companies obtained from the city franchises allowing them to operate cars by electricity at a speed of 10 miles an hour, and that the later speed ordinances were, therefore, direct violations of the previous grant to the companies. The counsel for the Brooklyn City & Newtown Company made answer that the speed ordinances were unconstitutional, and that they were passed without authority of law and in excess of any power given by the city. The cases were set down for trial on July 15.

TRACTION TO PAY MORE TAXES.—The Newark tax commissioners have increased the taxable valuations of the Consolidated Traction Company, Newark & South Orange and Rapid Transit Street Railway Companies and the New York & New Jersey Telephone Company $770,000. The separate assessments have been fixed as follows: Consolidated Traction Company, $1,700,000, an increase of $200,000; Newark & South Orange Railway Company, $600,000, an increase of $200,000; New York & New Jersey Telephone Company, $200,000, an increase of $70,000. The Rapid Transit Railway Company has been assessed at $300,000, whereas last year the company was not assessed at all. The latter company's plant is operated under lease by the Consolidated Traction Company, and the taxes thereon will have to be borne by the latter corporation. This means that that company's valuations have virtually been increased half a million dollars. The Rapid Transit property was included in the $1,500,000, at which figure the valuation of the Consolidated Traction was placed last year by the Tax Board.

FENDERS FOR BROOKLYN TROLLEY CARS.—President Rossiter, of the Brooklyn Heights Railway Company, is to have all the company's trolley cars

equipped with the Baltimore fender, which he considers to be the best device of the kind so far brought out. Mr. Rossiter has inaugurated some new regulations relating to the employees of the company; hereafter all motormen employed by the company will have to submit to a physical examination, and only thoroughly able men will be employed. All employees of the company whose duties bring them in contact with the public, including starters, inspectors, conductors, motormen, transfer agents and switchmen, will be required to wear when on duty the full uniform prescribed by the company. Indulgence in intoxicating liquors by employees will result in dismissal, and smoking or other use of tobacco by any uniformed employee while on duty is strictly prohibited. Conductors have instructions to announce in a clear and distinct manner the name of each cross street before arriving thereat, and on arriving at transfer stations, state the points to which transfers are made. Mr. Rossiter has expressed himself as having no feeling whatever against the former employees who took an active interest in the recent strike, excepting those who engaged in destroying the company's property, and he says that applications for employment will be considered upon their merits, without any discrimination whatever against the former employees referred to.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
936 Monadnock Building, Chicago,
July 12, 1895.

ZIEGLER BILL DISMISSED.—William Ziegler's bill with the amendments asking for a receiver for the Lake Street Elevated Railway of Chicago was thrown out of court last week by Judge Showalter. It was agreed that the demurrer to the original bill should stand as against the amended bill, and a brief argument was made by the attorneys, but the court held that the amendments added no new features to the original bill.

NORTH CHICAGO RAILWAY COMPANY VICTORIOUS.—Philip Kuby was hurt by a collision between a wagon in which he was riding and one of the cars of the North Chicago Street Railway Company, who compromised with him by the payment of $1,000. His lawyers, however, had the suit reinstated by claiming that Kuby had assigned his claim to them before he had settled with the company, and they tried the case as plaintiffs. Judge Chetlain instructed the jury that if the assignment which Kuby made to his lawyers was an agreement with the lawyers to maintain the suit and pay the fees and other expenses, such agreement was illegal, and the plaintiffs could not recover anything on the strength of it. The jury returned a verdict in favor of the railway company.

ST. LOUIS, MO.—Judge Valliant has handed down an opinion in the case of the Grand Avenue Railway Company vs. the Lindell Railway Company. The former company uses about four blocks of the latter's double tracks. The commissioners appointed by the mayor, after hearing all the testimony, returned a majority and a minority report. The majority awarded a yearly compensation of $5,297.60 to the Lindell for the use of its tracks by the latter. The minority report was for a smaller sum. Both companies appealed to the Circuit Court for a rehearing. The case was brought before Judge Valliant. The court overrules the defendant's exceptions to the commissioner's report, and plaintiff's exceptions are sustained, and the report is set aside. The court fixes $983.33 as the annual compensation to be paid by plaintiff to defendant.

CHICAGO METROPOLITAN CAPITAL INCREASED.—The stockholders of the Metropolitan Elevated Company, Chicago, last Saturday voted to increase the capital of that company from $15,000,000 to $30,000,000. The new issue of $15,000,000 is to be preferred to the extent of 6 per cent. dividends, although the dividends are not to be cumulative and the stock may at any time be converted into regular common stock, share for share. It is their intention to issue no more bonds. The company originally had a capital of $15,000,000 common stock, and a mortgage was made authorizing an issue of $15,000,000 5 per cent. bonds. The construction company was to get all the stock and bonds for building the road, and has already disposed of $10,000,000 of the bonds and given $2,500,000 of the stock as a bonus. The construction company, therefore, holds now $7,500,000 stock of the elevated company, and would under the original contract have received $5,000,000 more stock and $5,000,000 more bonds on the completion of the road. This remaining $5,000,000 of the bond issue will not be made under the new arrangement, the construction company taking preferred stock instead.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, July 3, 1895.

CENTRAL LONDON RAILWAY.—I understand that the public did not come forward very readily to subscribe the money required for the carrying out of this line, and that most of the shares have been taken up by the promoters themselves.

POSTOFFICE TELEPHONE TRUNK WIRES.—Notwithstanding the very complete "twisting" of the postoffice telephone circuits, it is found that when a large number are running on the same pole and are in operation simultaneously, the cross talk is appreciable. To remedy this the circuits are being crossed at the poles at long intervals.

THE TELEPHONE INQUIRY COMMITTEE.—The parliamentary committee which has for some time past been hearing evidence as to the condition of the telephone service of the United Kingdom, will not, owing to the general election which is to take place on Monday, make a report on the evidence it has received, and the matter will probably be indefinitely shelved. Had there been sufficient time for the committee to consider and draw up a set of specific recommendations to parliament with regard to the telephone service of this country, I believe the result would have been anything but pleasant to the rabid opponents of the National Telephone Company. Instead of overwhelming this concern with curses, it is possible that the committee would have given it something like a blessing.

A MUNICIPAL CENTRAL STATION IN A THUNDER STORM.—The Halifax Municipal Electric Lighting Station suffered last week a somewhat unusual experience for this country. During the height of a thunder storm two house transformers about one and a half miles from the works were struck and put to earth. A few minutes afterward a flash struck an alternator which was running, and disabling three armature coils, went to earth by jumping the air space and thence through the shaft and bedplate. Two of the staff experienced sharp shocks. By this time the water, which was rushing in torrents down a steep slope, leading from the town to the station, had entered the boiler house and had risen within a few inches of the fires. By dint, however, of hard work, the staff on duty were able to keep the fires alight. In addition to this one of the sub-stations became flooded to the depth of over five feet, completely immersing the 20-kw transformer. Notwithstanding the fact that all the apparatus was under water for 15 hours, no harm was done, and the supply was not interrupted for more than the few seconds required to switch in a new alternator in place of the damaged one.

General News.

TELEGRAPH AND TELEPHONE.

RALEIGH, N. C.—The North Carolina State Telephone Company has been organized with L. H. Carr, of Durham, as president. Three thousand miles of wire have been ordered, and Wilmington, Winston, Raleigh, Goldsboro, Durham, Greensboro and Charlotte will be connected. It is intended eventually to include all the principal towns in North Carolina and South Carolina in this long-distance system.

WASHINGTON, D. C.—The district commissioners are placed in a peculiar position with regard to the new telephone system just installed. Along with other apparatus, 200 sets of telephone transmitters were purchased with which was to be given a guarantee against suit for infringement, but the manufacturer of the transmitter is evidently dubious about the decision rendered in the Boston Circuit Court of Appeals sustaining the Berliner patent, and the commissioners have so far been unable to obtain the required guarantee. Unless the guarantee is forthcoming, the transmitters will be taken out, although the new system is working very satisfactorily.

ELECTRIC LIGHT AND POWER.

CLEBANSE, ILL.—The village authorities are discussing the question of electric lighting.

ST. CLAIR, PA.—The citizens have voted to issue $9,000 in bonds to increase the electric light plant.

WASHINGTON, N. C.—John R. Ross can give information concerning the lighting of the city by electricity.

SCOTLAND NECK, N. C.—A. McDowell can give information concerning the erection of an electric light plant.

ABERDEEN, MISS.—The mayor can give information concerning the re-establishment of the electric light plant.

McCOMB, O.—W. A. Shelt, of Napoleon, has made the village of McComb a proposition to put in an electric light plant.

HAWKINSVILLE, GA.—The mayor can give information concerning the erection of a new electric light and water works.

NEWCASTLE, PA.—The Citizens' Electric Light & Power Company's plant was sold by the sheriff on last Saturday for $2,600, subject to a mortgage of $3,650.

BROOKLINE, MASS.—At a recent meeting of the Board of Selectmen, the New England Telephone Company was granted permission to construct underground conduits.

LANSINGBURGH (P. O. TROY), N. Y.—Contract for lighting the village by electricity has been let to the Beacon Electric Lighting Company. An appropriation of $13,000 has been made for the purpose.

SCRANTON, PA.—A syndicate of Pennsylvania capitalists has decided to locate a 1,000-hp electric plant at Scranton, for the treatment of ores by the electrometallurgical process.

HASTINGS, NEB.—The local electric light plant has been sold to foreclose a mortgage for $13,000, which was held by Adam Cook, Jr., of New York City. Mr. Cook bought the plant in for $10,000.

CLEVELAND, O.—The city authorities have notified the telephone, telegraph and electric light companies that all their wires in a certain district must be put underground without any further delay.

JAMESTOWN, N. Y.—The superintendent of the municipal plant has been authorized to make extensions to the incandescent lighting system, and will purchase the necessary material and supplies for the same.

EVANSVILLE, IND.—The City Council has awarded the Evansville Gas & Electric Light Company the contract for lighting the city for a term of five years, beginning Aug. 11, 1895. The price to be paid is $95 per year for each 2,000-cp arc light burning all night and every night.

EVANSTON, ILL.—The Evanston City Council passed an ordinance giving the Evanston Illuminating Company the right to maintain a light, heat and power plant, and sell its product for a term of 25 years. The company has been furnishing Evanston with electric lights, under an ordinance, for several years, but has no right to do business in South Evanston or North Evanston, which have been annexed since the old ordinance was passed.

MANHEIM, PA.—A charter has been granted to the Manheim Light, Heat & Power Company, capital stock $20,000. The directors are Vance C. McCormick, Harry B. McCormick, Harrisburg; F. E. Bailey, Philadelphia; L. U. Bailey, Dillsburg, and Robert A. Carl, Harrisburg. The plant will be built at once by F. E. Bailey & Co., of Philadelphia, and the power used will be steam and water combined. The streets will be electrically lighted and lights and power will be furnished to citizens of Manheim and vicinity.

THE ELECTRIC RAILWAY.

WATERLOO, N. Y.—Ground has been broken for the erection of an extensive power house and depot in Waterloo for the Geneva & Cayuga Lake Railway Company.

FAIRMOUNT, W. VA.—A charter has been issued to the Fairmount Suburban Railway Company, giving it the right to construct a street railway in the town of Fairmount.

SYRACUSE, N. Y.—W. B. Cogswells, C. B. Tracy and G. Higgins, are interested in the erection of a new electric railway between Syracuse and Manlius. Capital stock $250,000.

CAMDEN, N. J.—The West Jersey Traction Company has filed a petition with the City Council asking for the location of certain routes of its railway on certain streets of the city

NEW ORLEANS, LA.—Moss & Gerdes have made an application in the parish of Jefferson for a franchise to construct and operate an electric railway from New Carrollton to East End.

NEWBURYPORT, MASS.—The Board of Aldermen has granted the People's Street Railway Company an extension of time in which to build a line through Storey Avenue to West Newbury.

CHICAGO, ILL.—Chicago & Northern Pacific Railway is having estimates prepared for the contemplated changes in motive power from steam to electricity on suburban trains

ALBANY, N. Y.—The Albany Railway Company has decided to expend a considerable amount of money in improving its lines. The officials state that about $40,000 have been expended.

ELIZABETH, N. J.—The directors of the Elizabeth Street Railway Company have decided to equip the road with the trolley system. About $125,000 will be necessary for the proposed improvements.

WESTPORT, CONN.—The Westport & Saugatuck Horse Railway Company has gained legislative authority to increase its capital stock to $100,000, to extend its line and to equip it with electricity.

UTICA, N. Y.—Application has been made by the Utica & Herkimer Street Railway Company for consent to build and operate a surface railway in Utica, to be operated by electric power.

COLUMBUS, MO.—The City Council has granted Col. E. C. Moore a franchise to construct a street railway from the northern to the southern limits of the city, the same to be operated by either horse or electric power.

NEWPORT NEWS, VA.—A trolley line has been put down from the Chesapeake & Ohio Railway station to the plant of the Newport News Shipping & Dry Dock Company, and cars will begin running within a day or so.

CHARLESTON, W. VA.—The Charleston Street Railway & Electric Light plant has been sold to New York capitalists, and will be improved to the extent of about $50,000. Charles B. Couch can furnish additional information.

GREENFIELD, MASS.—The promoters of the projected electric road between the freight station at Shelburne Falls and Colrain propose to apply for a charter at the legislature, and hope to start construction early in the spring.

WASHINGTON, D. C.—The Washington & Great Fall Electric Railway of which J. P. Clark is president, and W. E. Lewis, secretary, has sold bonds to the amount of $100,000 for the purpose of constructing its electric railway.

GRETNA, LA.—Messrs. Morse & Gerdes, also B. T. Waldo, have asked for franchises to build electric roads in Jefferson Parish, the first is to extend from East Carrollton to East End, and the second from Upperline to Kennerville.

RICHMOND, IND.—The Richmond Street Railway plant was sold to-day, to satisfy a decree in favor of the Union Trust Company, of St Louis, which held $200,000 worth of bonds. A number of intervening creditors also have claims.

NEW HAVEN, CONN.—The Board of Aldermen have granted permission to the Manufacturers' Street Railway Company to construct its road and equip with electricity in accordance with permission of the general street railway act.

PARAGOULD, ARK.—E. M. Harrison, of the Harrison Electric Company, of Chicago, with J. D. Block and others, of Paragould, are promoting an electric line from Siloan Springs, Ark., through Paragould to Gayoso, Mo., on the Mississippi River.

PITTSBURG, PA.—The Fort Pitt Traction Company contemplates building a new line to the east to parallel the Pennsylvania Railway. Josbua Rhodes is president of the new company. It is said the new line will be completed before Oct. 1, and will cost $800,000.

BALTIMORE, MD.—It has been announced that bids have been asked to complete the Baltimore & Washington electric line by the Columbia & Maryland Railway Company, of which T. M. Lanahan, of Baltimore, is president. It is stated that the road is to be doubled tracked throughout, and completed by June, 1896.

NEW ORLEANS, LA.—It is reported that Philadelphia parties have secured control of the Canal & Claiborne Company, and will convert its lines at once into a trolley system. With the extensions proposed, 19 miles of line will be built. Ford & Bacon, of Philadelphia, Pa., are the engineers; I. H. De Grange is president.

COLUMBIA, PA.—After several weeks' delay, everything is now ready to begin the construction of the Columbia, Ironville & Mt. Joy Electric Railway. The lease which was pending between the two companies, the Columbia & Ironville Company and the Railway Company, has been signed. H. H. Heise and Col. Bratton are interested.

TOWSON, MD.—A stock company has been formed by Geo. S. Metter, Dr. W. Crim, S. J. Carr, of the Carr-Lowery Glass Company, and Wm. F. Porter, of Johns & Porter, and others, for the purpose of building an electric railway to connect Mt. Winans, Westport, Lansdowne and Metter's Park with Baltimore. The capital stock is $75,000.

PHILADELPHIA, PA.—The city solicitor has filed a bill in equity on behalf of the city against the commissioners of Fairmount Park, William Wharton, Jr., and the Fairmount Park Transportation Company. The object of the proceeding is to prevent the construction in the park of a railway until the consent of the city has been first obtained.

PONTIAC, MICH.—Work has been begun on the electric railway. The line will be double-tracked through the business part of the town, and the route will include the leading streets, besides a run to Sylvan Lake, and to the asylum. The syndicate building the road, headed by M. B. Mills, of Detroit, claims that cars will be running by Sept. 1.

JAMAICA, L. I., N. Y.—Col. A. A. DeGrauw, one of the wealthiest men and a large stockholder in the Jamaica & Hempstead Plank Road, has asked the Town Board of Jamaica to postpone proceedings to have the road condemned, as he is about negotiating with an electric railway company to build a trolley line over this route from Jamaica to Hempstead.

DAYTON, O.—The Dayton Traction Company has announced that arrangements are perfected whereby the road will be completed, and the electric line between Dayton and Miamisburg will be in operation by Sept. 1. This line is part of the system in contemplation between Dayton and Cincinnati, and it is said that Mayor Major, of Toledo, is one of the financial backers of the Dayton branch.

ST. LOUIS, MO.—The stockholders of the Southern Electric Railway Company have voted to construct and operate a trolley line between Carondelet and Jefferson Barracks. All the contracts for the material have been awarded, and work of construction will commence as soon as the license to run into the government reservation is received. The work of construction will be vigorously pushed to completion.

MISCELLANEOUS NOTES.

THE UNIVERSITY OF WISCONSIN has conferred the honorary degree of LL D. upon Edwin R. Reynolds, of Milwaukee, Wis., designer and builder of the Reynolds-Corliss engine, in recognition of his position as an expert of the highest rank and of international authority as a steam engineer, and on account of his remarkable ability and success as a designer and inventor; and upon Don J. Whittemore, of Milwaukee, Wis., chief engineer of the Chicago, Milwaukee & St. Paul Railway, in recognition of his distinguished services in the railway interests of the country.

Trade and Industrial Notes.

REMOVAL.—The Siemens & Halske Electric Company of America has removed its New England office to the Equitable Building, Boston.

PRESTON HOLLOW, N. Y.—Long-distance telephones will be put on the entire route of the new line recently built from Oak Hill to Middleburg.

RAHWAY, N. J.—A satisfactory agreement has been reached between the electric light and power company and the committee of the Common Council for lighting the streets with arc lights, service to begin as soon as the necessary appliances can be put in position.

NEW FIRM.—The firm of T. P. Benton & Co., manufacturers of electrical apparatus, at La Crosse, Wis., last week admitted to partnership Mr. W. D. McDonald, and the firm name was changed to Benton & McDonald.

CHAS. E. GREGORY, of Chicago, the man who revels in job lots and is always ready to buy, sell, or trade, has issued the fifth edition of his "Handy Telephone Directory." Electrical men visiting Chicago will find this little book a very convenient pocket companion.

CHANGE IN FIRM.—Frank K. Rogers having withdrawn from the firm of Berger, Rogers & Potter, the name of the firm has been changed to Berger & Potter. The firm has removed its offices from 620 Exchange Building, Boston, to 255-257 Broadway, Troy, N. Y., where a general engineering and contracting business will be prosecuted.

ELECTRIC SOLDERING IRONS, curling irons, disc heaters, etc., are now being turned out by the Carpenter Enamel Rheostat Company, of Hoboken, N. J. Mr. Carpenter is giving personal attention to the introduction of these goods which are meeting with a very ready sale. The company made the gratifying record during the recent depression of meeting every dividend.

H. WARD LEONARD sailed for Europe on the *Paris*, July 10, to be gone several months. Mr. Leonard will represent several interests while abroad and will be able to accept commissions from parties in the United States desiring investigation of electrical matters on the other side of the water. His address will be care of Low's Exchange, 57 Charing Cross, London, E. C., England.

GOOD ADVICE is always welcome, especially when it coincides with the judgment and natural inclinations of the recipient; therefore the trade at large will no doubt be glad to see the pamphlet entitled "Seasonable Suggestions," which is being distributed by the Electric Appliance Company, of Chicago, and which tells all about Swinging Ball Lightning Arresters and Meston Fan Motors.

THE EXCELLENT PERFORMANCE of a 700-hp, cross-compound Ball engine in the station of the Maryland Electric Company, Baltimore, has resulted in the placing of an order with the Ball Engine Company, Erie, Pa., for a duplicate engine. The Ball Engine Company has also received from the Union Electric Company, Manchester, N. H., an order for a 500-hp vertical cross-compound condensing engine.

A HANDSOME CATALOGUE of electric railway supplies has just been issued by the Ohio Brass Company, of Mansfield, O. The catalogue is designated as No. 3, and covers a most complete line of overhead and track construction material and car appliances. Some new specialties have been brought out since the company's previous catalogue was issued, notably a pipe bracket hanger, the Buckeye trolley harp Walker trolley harp and heel, and an extremely convenient horizontal track drill.

CHARLES WIRT, formerly of 56 Fifth Avenue, Chicago has removed his office to Ludlow Street, corner of 31st Street, Philadelphia. Mr. Wirt is still

making quantities of his "non-sparking" dynamo brushes and will soon bring out a new brush intended for use on dynamos and motors which are required to run with practically no attention between starting-up and shutting-down periods The Wirt switchboard instruments will hereafter be manufactured by Queen & Co., who have secured the rights from Mr. Wirt.

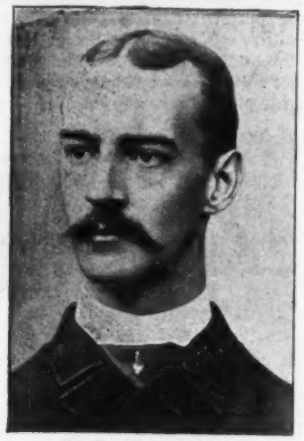
THE CHARLES SCOTT SPRING COMPANY, of Philadelphia, Pa., has just issued a new catalogue devoted to springs for street railways. The standard elliptic springs are first described and illustrated, and the rest of the catalogue is devoted to helical brush holder trolley and sash springs. The pamphlet contains views of the company's warerooom and machine shop, spiral department and elliptic departments. The company states that its long experience in the business, combined with the use of high-grade crucible steel, the newest and best machinery, and the employment of skillful workmen, justify it in claiming that its springs are in all respects unequalled.

UNIQUE EVIDENCE of the methods and ability of the manufacturers is embodied in a collection of blueprints neatly secured by silken cord between substantial and handsome covers, which the Link-Belt Engineering Company, 49 Dey Street, New York, is distributing. These blueprints, which, by the way, are beautifully executed, illustrate fuel-handling plants which have been installed for numerous customers by the Link Belt Company, thus demonstrating what the company *has done* in contradistinction to illustrating what it claims to be able to do, which is about the limit of the function of a conventional catalogue describing this and similar classes of apparatus.

"ELECTRICITY" is the suggestive title of an interesting little booklet which is being distributed by H. D. Bayne & Co., electrical engineers of 512 513 Mutual Life Building, New York. The subjects treated are "Interior Wiring," "Electric Elevators," "Central Stations" and "Railway Equipment," and the subject matter contains information of considerable value to those contemplating the installation of any of the various classes of equipment considered, as well as to central station men generally. Particular attention is called to the Bayne vacuum system of "fishing" wires through interior conduits, which method entirely obviates the liability to damaging the tubes which is attendant upon the use of "fishing wires" or chains. The Zell water-tube boiler, for which Messrs. Bayne & Co. are agents, is meeting with much success, among recent orders being one of 600 hp which was sold to Mr. Hammerstein for his new theatre, after an exhaustive investigation into the merits of this and many other boilers.

THE QUAKER CITY may not be recognized as an electrical centre, but it nevertheless possesses not an inconsiderable number of electrical firms which have become well known beyond her boundaries. Among these is the house of Frank H. Stewart & Co., manufacturers and dealers in electrical supplies and machinery, which has recently moved into new quarters at 35 North Seventh Street, in the heart of the business quarter of the city. Mr. Frank H. Stewart the senior member of this firm, is a striking example of what hard work and close application may accomplish. He was born on a farm in Mannington township, Salem County, N. J., and, like almost all farmers' sons, did nearly all kinds of farm work. After clerking in a country store for a few months he went to Philadelphia and attended a well-known business college, taking a course in mercantile law and bookkeeping. As soon as he graduated he commenced studying shorthand, and graduated in this branch also, being one of four in a graduating class of over one hundred who succeeded in completing both courses in the time usually required for one. On leaving school he entered the employ of an electrical supply house, which appreciated his abilities enough in a few months to give him the position of traveling salesman. He held this position nearly three years, or until he started in business for himself. Mr. Stewart has made scores of friends in all parts of the country and in all branches of the electrical field. Mr. P. Logan Bockius, the junior member of the firm, was born in Camden, N. J., 36 years ago, and received his education in the public and academic schools of Philadelphia. After completing his educational course it became his desire to possess a trade, and although his parents were in affluent circumstances he served a regular apprenticeship of four years at the morocco business He was employed by Wm. Ayres & Sons, the largest manufacturers of horse clothing in this country, for a number of years and served under them in many confidential and responsible positions. Mr. Bockius is descended from old and prominent Philadelphia families, and is a direct descendant of the Logans who came to this country with William Penn, James Logan being appointed by Penn first Governor of Pennsylvania.

F. H. STEWART.



P. L. BOCKIUS.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 9, 1895.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

11,503. AUTOMATIC ELECTRIC WEIGHING SCALE; Charles F. Wood, Richmond, Va. App. filed Jan. 29, 1894. The combination with a main hopper and a scale beam, of a receiving hopper or receptacle carried by the scale beam, a transfer hopper or funnel adapted to receive material for the receiving hopper and discharge it into a bag; electromagnetic devices for controlling the discharge of material from said hoppers or receptacles, electromagnetic devices for controlling the operation of the transfer hopper or funnel, and means for controlling all of said electromagnetic devices whereby to render the operation of the apparatus automatic and continuous to weigh and discharge predetermined quantities of material as long as the main hopper or receptacle is kept charged therewith.

542,228. TROLLEY BREAKER; Henry P. Ball and Charles A. Lieb, New York. App. filed Aug. 8, 1894. A trolley breaker consisting of metallic end pieces and three longitudinal bars arranged in a vertical plane and spaced from one another, the top bar being a compression member and the lowest bar an extension member, said bars having their ends connected to and insulated from the metallic end pieces, and the lowest bar being removable from the metallic end pieces without disturbing the other parts of the trolley breaker.

542,240. ELECTRIC METER; Frank P. Cox, Lynn, Mass. App. filed Feb. 15, 1895. The combination of a constant-current circuit with a meter motor coupled in circuit, with the field winding and translating devices forming one side of a Wheatstone bridge, the armature and a resistance the second side of the bridge, and a resistance corresponding to the bridge wire adjusted to give a starting torque to the motor.

542,242. CAR FENDER; Robert C. De Vault, Philadelphia, Pa. App. filed March 29, 1895. The combination with a car, of a fender therefor, consisting of side frames pivoted to brackets on the under side of the car, and also pivoted at their central points, springs for normally holding the parts of said side bars in a direct line, a transverse bar connecting the outer ends of said side frames, a supporting platform for said fender made up of a series of angularly disposed rods pivoted at their central and outer portions, connected to said transverse bar and to the under side of the car, a pair of pivoted dogs adapted to hold said side bars in their folded position, and means for actuating said dogs.

542,249. TELEPHONE SWITCHBOARD; James F. Gilliland, Adrian, Mich. App. filed Oct. 26, 1894. In a telephone switchboard, the combination with telephone lines, of movable plugs having normally closed spring contacts connected with the telephone lines, of a series of pairs of flat connector plates, insulated from each other and adapted to have the spring contacts of the plugs pushed over them.

542,258. ELECTRICAL MEASURING INSTRUMENT; Frank Holden, Schenectady, N. Y. App. filed Jan. 22, 1895. In an electric measuring instrument, a field coil deeper at one part of its circumference than at another, an index mounted in the axis of the coil and a yoke of magnetic material carried by the index, the sides of the yoke being arranged to embrace the coil and being parallel to the axis thereof.

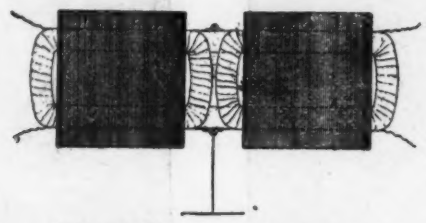
542,262. MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES; Milo G. Kellogg, Chicago, Ill. App. filed Dec. 21, 1889. A spring-jack switch adapted to receive a switch plug, consisting of a metal frame through the front of which is the switch hole, a contact-spring or piece insulated from the metal frame and placed with its length parallel to the axis of the hole, and a second contact-spring or piece insulated from the first contact-spring and normally insulated from the metal frame, placed parallel to said first spring and operated by it to be pressed into connection with said metal frame while a plug is in the switch hole.

542,268. ELECTROPROTECTIVE SYSTEM FOR LOCKS; Morris Martin, Malden, Mass App. filed Oct. 4, 1894. In an electroprotective system for stores and like places, the combination of the following instrumentalities, viz.: An electric circuit provided with a test circuit controller and with one or more auxiliary circuit controllers, a lock provided with a bolt, and a key to operate said bolt, rendered effective to move the bolt in one direction by the operation of the test circuit controller, for the purpose specified.

542,276. CAR FENDER; Daniel O'Mahony, Jersey City, N. J. App. filed April 4, 1895. The combination with the platform of a car, of a main fender or guard frame pivotally connected with hangers supported from the platform and carrying at its front end a supplemental guard or fender pivotally connected therewith and adapted to be folded thereon or projected in front thereof, said main frame being also provided with sweepers adapted to move in contact with the track and clean the same,

542,279. ARC LIGHT SUPPORT; Barton Pickering, Dayton, Ohio. App. filed Nov. 15, 1890. In combination with the spring-actuated catch having an inclosing case, the shouldered hanger head to engage said catch, the gravitative dog held in the ears of said catch to hold said head out of engagement with said catch, when by bearing against the face of the same, the same is withdrawn from contact with said hanger.

542,295. TRANSFORMER FOR ALTERNATING-CURRENT SYSTEMS; Elihu Thomson, Swampscott, Mass. App. filed March 6, 1895. A transformer for alternating currents, comprising two laminated cores, primary coils wound around one of the cores, secondary coils upon the other, and plates or links of copper connecting the cores and adjacent to primary and secondary coils, the plates being connected to earth. (See Illustration.)



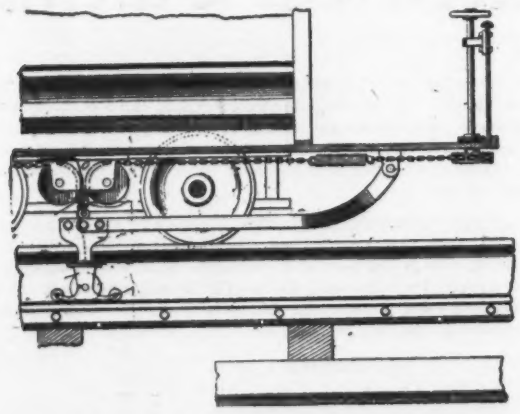
No. 542,295—Transformers.

542,303. CAR GUARD OR FENDER; Henry Burden, Troy, N. Y. App. filed April 8, 1895. The combination with a net for a car guard or fender composed of a series of elastic tube sections strung upon chains or wires arranged to intersect each other angularly between the tube parts and to connect thereat; of a fender bar provided with an elastic covering at its front side connected to the lower end of said net, and a top rail connected to the upper end of the net.

542,309. ELECTRIC BRAKE; William B. Potter, Schenectady, N. Y. App. filed March 20, 1895. In a braking apparatus and in combination, a wheel or moving element, a brake shoe co-operating therewith in arresting its motion, means for manually actuating a part of the brake shoe, means for electrically actuating the entire shoe, and a stop preserving the relation of the shoe to the axle of the wheel; whereby the shoe may be maintained as close as desired to the tread of the wheel.

542,406. ELECTRIC ALARM GAGE; William H. Bradt, Troy, N. Y. App. filed Feb. 28, 1894. In an electrical alarm gage, the combination with the index, of a cap having a rotary perforated rim, a contact insulated from such rim and fixed thereon to project through the rim aperture into the path of the index and means for connecting the index and contact with the battery wires.

542,434. UNDERGROUND TROLLEY; Leedham Binns, Philadelphia, Pa. App. filed April 11, 1894. An underground trolley, comprising a frame adapted to be pivoted to the car, a head secured in the free end of the said frame, a trolley pulley journaled in a frame attached to the said head, chains connected with the said head and extending in opposite directions under the car, and means for winding up or unwinding the said chains to impart an upward or downward swinging motion to the said frame. (See Illustration.)



No. 542,434—Underground Trolley.

542,444. TELEPHONIC TRANSMITTER; Charles C. Hughes, Baldimore, Md. App. filed Sept. 12, 1894. A telephone transmitter comprising a diaphragm adapted to receive sound waves, an electrode secured thereto, a second diaphragm having a similar electrode secured thereto, each of said electrodes having a cavity whose sections in planes perpendicular to the direction of motion are arcs of circles of gradually varying radii and a free electrode held in suspension by the aforesaid electrodes, and having an exterior surface whose sections in planes perpendicular to the direction of motion are also arcs of circles of varying radii, the radii of the arcs of normal contact of the electrodes differing in value. (See Illustration.)

542,459. ELECTRIC BATTERY AND APPLICATION THEREOF TO MEDICAL PURPOSES; Seth R. Beckwith, Orange, N. J. App. filed April 8, 1895. An electric battery consisting of a frame open at the sides and a plurality of battery elements composed of metallic plates, in width equal to the thickness of said frame, laid lengthwise therein so as to be entirely surrounded thereby or locked together and held in position by friction.

542,462. ELECTRIC INSULATING MATERIAL; James O. Brown, Chicago, Ill. App. filed May 5, 1894. An electric insulating material consisting of quartz, pyrites of iron, and oxide of manganese, made into a vitrified mass.

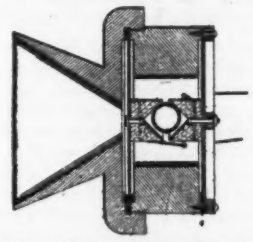
542,471. ELECTRIC BATH APPARATUS; William E. Golden, Auburndale, Ohio. App. filed March 5, 1895. An electric bath apparatus, consisting of an electric generator, an induction coil in circuit therewith, and a registering and clock mechanism operating in connection with the generator and coil and forming part of the electrical circuit between the two.

542,480. CAR FENDER; Joseph Leightham, Reading, Pa. App. filed March 21, 1895. A car provided with supporting plates extending upwardly in front of the dash and rigidly secured to the beams beneath the platform, the upper ends thereof formed to have a fender hinged removably thereto, and swinging guides having springs for the lower part of the fender carried by the supports beneath the plane of the platform.

542,481. CAR FENDER; Joseph Leightman, Reading, Pa. App. filed April 8, 1895. A car having forwardly extending slidable fender, supporting arms extending beneath the platform to a point in front of the dash, brackets depending from the platform and having swinging guides provided with springs, the fender pivoted at its sides in said arms and formed to receive said guides and be held by the springs.

542,487. ELECTRIC LIGHTING SYSTEM AND DYNAMO THEREFOR; Morris Moskowitz, Newark, N. J. App. filed May 11, 1895. The combination, with a working circuit containing lamps or other translating devices, of a dynamo in said main circuit, and a reversible driving power for operating the same, said main circuit being wound in a differential series coil around the field of said dynamo, a pole changer in said main circuit, a self-excited field coil on said dynamo in circuit with its armature, and opposing high resistance field coil in circuit with and fed from said dynamo, and a pole changer in circuit with the dynamo armature and said field coils.

542,490. ELECTRIC ARC LAMP; Samuel E. Nutting, Oak Park, Ill. App. filed Sept. 8, 1894. An arc lamp having a carbon-controlling mechanism consisting of a suitable conductor secured at either end to fixed cross-heads and placed in the circuit of said lamp, and a carbon-actuating mechanism consisting of a spring-actuated lever suitably connected to the brake and brake wheel and relative parts, said lever adapted to bear centrally against said conductor and its part to be actuated thereby. (See Illustration.)



No. 542,444—Telephone Transmitter.

542,505. ARC LAMP; Albert C. Seibold, Mount Vernon, N. Y. App. filed Jan. 7, 1895. The combination with the globe of an arc lamp, of a cap attached to the bottom thereof containing a conical collecting chamber and a tubular discharge through which the lower electrode passes, an internal foraminous guard surrounding the arc and extending throughout the length of the globe, and a cap closing the top of the globe and provided with an orifice for the passage of the upper electrode.

542,512. ELECTRIC RAILWAY SYSTEM; Robert B. Wilson, Cincinnati, Ohio. App. filed Jan. 2, 1894. In an electric railway system, the combination with a main lead conductor and a sectional conductor, each section of which has its own connection with the lead conductor, the connection being separate from and independent of any other connection, normally open and disconnected from the lead conductor and adapted to be closed from a current from a preceding section and thereafter to be kept closed by a current through itself direct to the return, of means of opening the connection mechanically by a passing car.

542,548. ELECTRICALLY CONTROLLED MOTOR; George L. Thomas, Brooklyn, N. Y. App. filed April 25, 1895. In combination, means for retaining a supply of fluid under compression, an expansible chamber, means for communicating the movement of the expansible chamber to the work to be done, means for admitting the actuating fluid to and discharging it from the expansible chamber and means for automatically cutting off the admission of the actuating fluid to the expansible chamber at a predetermined point in the movement of the expansible chamber.

542,550. RAILWAY BLOCK SIGNAL SYSTEM; George M. Brown, Galesburg, Ill. App. filed May 4, 1895. A railway block signal system comprising a plurality of sources of electricity, a continuous traffic rail, a second traffic rail composed of plurality of sections insulated from each other, a conducting rail composed of a series of conductors continuous through each block and insulated from each other; a second conducting rail composed of a series of conductors and consisting of a plurality of broken sections in each block, insulated from each other; electromagnets connecting the insulated sections of the traffic rail, and circuit breakers operated by the said magnets and connecting the insulated sections of the broken conducting rail; and signals operated by the current from the conducting rails.

542,589. ELECTRIC ARC LAMP; Frank M. Hildebrandt, Edwin S. Hildebrandt and Henry F. Hildebrandt, Baltimore, Md. App. filed Dec. 27, 1893. An arc lamp having the electrodes around the arc inclosed in a small transparent or translucent normally air-tight casing, said casing being provided in its upper end with a valve or valves normally closed whereby the casing is filled with a highly luminous gas and the longevity of the electrodes is extended.

542,591. TROLLEY-FENDER; Charles C. Lynde, Buffalo, N. Y. App. filed Nov. 28, 1894. A trolley guide consisting of a frame centrally pivoted to the trolley pole in its lower portion having a loop encircling the trolley pole to limit its swinging movement and its upper swinging portion having a cross piece adapted for contact with the lower side of the trolley wire.